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Wastewater Management Plan for the Durango Area La Plata County, Colorado. Draft Environmental Impact Statement

Engineering-Science, Inc.
Denver, CO

Prepared for

Environmental Protection Agency
Denver, CO

Feb 81

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National Technical Information Service
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16. ABSTRACT

Environmental effects of wastewater management were considered for six areas outside of the Durango City limits in La Plata County, Colorado. Three basic wastewater management alternatives were proposed for each Study Area: (1) No Action (2) Formation of a Maintenance District, and (3) Sewers, either with a local treatment facility or with connections to the City of Durango's system. Environmental impacts of the No Action and Maintenance District alternatives include possible degradation of water quality, potential public health threats, and septage and sludge disposal. While it would reduce these impacts and save electrical energy, the sewer alternative might lead to increased growth rates, strip development along the sewer lines, and increased population density. The Maintenance District and sewer alternatives would also impose substantial financial impacts on residents, particularly those with properly operating existing systems. Connection with the City of Durango's system could lead to annexation under implied consent rules. No Action was recommended for the West Animas and Florida Road Study Areas. Interceptors to the City of Durango system were recommended for the remainder of the Junction Creek and Lightner Creek areas. Local sewage treatment plants with sewers were recommended for the Hermosa and Grandview/Loma Linda areas.

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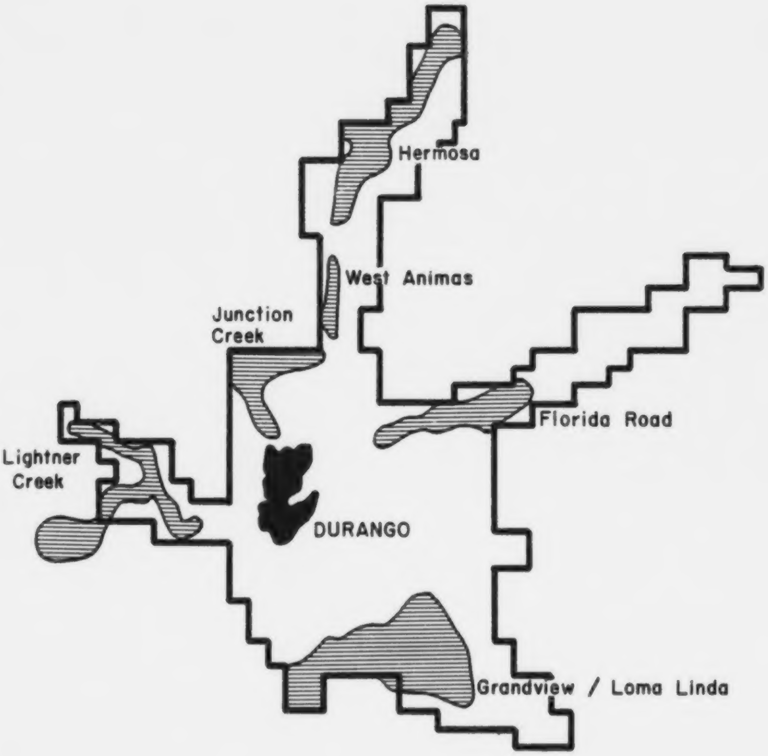
Hermosa
West Animas
Junction Creek
Florida Road
Lightner Creek
DURANGO
Grandview / Loma Linda

Wastewater Management Plan for the Durango Area, La Plata County, Colorado

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
WASTEWATER MANAGEMENT PLAN FOR THE DURANGO AREA, LA PLATA COUNTY, COLORADO

Prepared by

U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Approved by:
Roger L. Williams
Regional Administrator

Date: Feb 24, 1981

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SUMMARY SHEET

ENVIRONMENTAL IMPACT STATEMENT

WASTEWATER MANAGEMENT PLAN FOR THE DURANGO AREA, LA PLATA COUNTY, COLORADO

Prepared by the U. S. Environmental Protection Agency, Rocky Mountain Prairie Region, Region VIII, Denver, Colorado, with assistance from Engineering-Science, Inc., Denver, Colorado, Cap Allen Engineering, Durango, Colorado, and Gruen, Gruen + Associates, San Francisco, California.

A. Type of Action: (X) Draft EIS
( ) Final EIS

B. Brief Description of the Proposal

The Region VIII Administrator of the U. S. Environmental Protection Agency (EPA) is considering approval of Federal matching funds for wastewater treatment facilities for the City of Durango, Colorado, through Title II of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), as amended in the Clean Water Act of 1977 (PL 95-217). Eligibility requirements and procedures necessary to qualify for a grant are set forth in 40 CFR, Part 35, Construction Grants for Wastewater Treatment Works. The Federal share will be 75 percent of the total cost found to be eligible.

The purpose of this environmental impact statement is to present an evaluation of the environmental impacts of a plan submitted by the City of Durango and La Plata County proposing to construct wastewater collection and treatment systems in portions of the 201 Study Area that are not presently being served by the City of Durango's wastewater treatment system.

C. Lead Agency, Project Officer Contact and Address

The U. S. Environmental Protection Agency is the lead agency in a joint effort with the State of Colorado, La Plata County, and the City of Durango, Colorado, to approve plans, necessary permits, and finance or award grants in order to implement this proposal. Mr. John M. Brink, U. S. Environmental Protection Agency, Region VIII is the designated project officer.

Mr. John M. Brink, Project Officer
U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

or call (303) 837-4831.

D. Abstract of the Proposed Action

Environmental affects of wastewater management were considered for six areas outside of the Durango City limits in La Plata County, Colorado. Three basic wastewater management alternatives were proposed for each Study Area: (1) No Action, (2) Formation of a Maintenance District, and (3) Sewers, either with a local treatment facility or with connection to the City of Durango's system. Environmental impacts of the No Action and Maintenance District alternatives include possible degradation of water quality, potential public health threats, and septage and sludge disposal. While it would reduce these impacts and save electrical energy, the sewer alternative might lead to increased growth rates, strip development along the sewer lines, and increased population density. The Maintenance District and sewer alternatives would also impose substantial financial impacts on residents, particularly those with properly operating existing systems. Connection with the City of Durango's system could lead to annexation under implied consent rules. No Action was recommended for the West Animas and Florida Road Study Areas and for portions of the Junction Creek and Lightner Creek Study Areas. Interceptors to the City of Durango system were recommended for the remainder of the Junction Creek and Lightner Creek areas. Local sewage treatment plants with sewers were recommended for the Hermosa and Grandview/Loma Linda areas.

E. Date filed with EPA and listed in the Federal Register: MAR 2 0 1981

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CHAPTER 1

SUMMARY

In 1978 a Wastewater Treatment Facilities Plan (201 Plan) for the Durango area in La Plata County, Colorado was submitted to EPA for approval. The plan recommended construction of 28 miles of interceptor sewers into presently unsewered areas outside the Durango City limits. The sewering plan was designed to eliminate several privately owned sewage treatment plants and septic tank systems that were thought to be polluting the Animas River and its tributaries. There were a number of potentially adverse environmental impacts associated with the recommended alternative, and EPA decided an Environmental Impact Statement was required to assess these consequences and to explore alternatives of solving these problems. Subsequently, an amended Facilities Plan was prepared. The amended plan addressed wastewater management needs in six areas outside of the Durango City limits.

All of the six areas of concern are presently unsewered. A total of 46 privately owned multiple customer facilities provide much of the wastewater treatment for the six areas. The remaining wastewater is treated on-site, with systems ranging from septic tanks with leach fields to aerated lagoons to evapotranspiration ponds. A recent sanitary survey indicated that many of the package plants and some of the on-site systems have experienced failures in the past, are currently not providing adequate treatment of wastewater, and/or are expected to experience failures in the near future.

Three basic wastewater management alternatives were proposed for each Study Area: (1) No Action, (2) Formation of a Maintenance District, and (3) Sewers, either with a local treatment facility or with connection to the City of Durango's system. Subalternatives of the sewering option in each Study Area included providing sewer service only to selected portions of the area.

A major impact of the No Action alternative is the threat to water quality and public health by continued reliance on existing systems. This threat will continue as long as on-site disposal systems and poorly maintained and/or operated package plants are used. However, most of the existing systems appear to be operating adequately, and the failing systems could be repaired, upgraded, or replaced by their owners to provide satisfactory wastewater treatment. Another consequence of this alternative is the continued need for septage and sludge disposal.

Treatment of wastewater by existing systems would continue with the formation of a Maintenance District, but responsibility for maintaining the systems would become the responsibility of the District. Environmental impacts of this alternative include those described for the No Action alternative. However, the potential public health and water quality threats would be considerably reduced by better monitoring and maintenance. Residents within the District would be required equally to support the District financially, regardless of the amount of maintenance their own system required.

The most important beneficial environmental impact of sewering an area would be to reduce the threats to human health and water quality imposed by the existing systems. Replacing existing package plants with sewers would also result in a net saving of electrical energy. However, the sewer option might lead to increased growth rates, strip development along the sewer line, and a greater population density in the areas where sewers were installed. Residents currently using satisfactory systems would be required to connect and/or contribute financially to the new sewer system. Additionally, if an area's sewers were connected to the City of Durango's system, the area could be annexed by the City at a future date under the City's implied consent rules.

Based on engineering analyses and public involvement, the following recommendations were made for wastewater management:

Local treatment plants with sewers were recommended for both the Hermosa and Loma Linda areas. Citizens in the Grandview area expressed a preference for connecting the area with the new wastewater treatment plant that Durango was planning to build several miles downstream of its existing facilities. However, the city may expand its facilities at the existing site rather than relocating at the downstream site, which is closer to the Grandview area. In that case, the first choice alternative recommended for the Grandview area would no longer be feasible. Consequently, Grandview residents attending a public meeting agreed that a lagoon system at Grandview would be the preferred alternative in the absence of a new City of Durango treatment plant at the downstream site the city had considered earlier. Aerated lagoons are the systems considered most effective in each of the three recommended areas.

Short interceptors connecting with the City of Durango system were recommended for parts of the Junction Creek and Lightner Creek Study Areas. The remainder of these Study Areas will be unsewered and will continue to rely on existing systems.

The No Action alternative was recommended for both the Florida Road and West Animas Study Areas.

CHAPTER 2

PURPOSE AND NEED

CHAPTER 2

PURPOSE AND NEED

The purposes of this EIS are to analyze and disclose the effects of providing or not providing sewer service to presently unsewered areas outside the service area of Durango, to analyze alternative means of solving the wastewater management needs of the Study Area in the most environmentally sound, cost-effective manner, and to examine potential impacts associated with developed alternatives on the significant environmental issues.

On February 28, 1978, a wastewater treatment facilities plan (201 Plan) for the City of Durango was submitted to EPA for approval. The plan addressed the wastewater management needs for the 93 square mile 201 planning area designated by the State Health Department. Included within the planning area are the Animas River Valley from the Southern Ute Indian Reservation boundary north to Bakers Bridge, Lightner Creek, the Upper Florida River area, and the Florida Mesa area, which includes Grandview, Loma Linda, and Air Park. (See Figure 2.1). The plan recommended the construction of a new wastewater treatment plant for Durango with a capacity of 5.36 million gallons per day (MGD). This plant capacity would be sufficient to treat the wastewater generated by approximately 37,000 people expected in the vicinity of Durango by the year 2000. The plan also recommended construction of 28 miles of interceptor sewers into presently unsewered areas in order to eliminate several small privately owned sewage treatment plants that were thought to be polluting the Animas River and its tributaries. The proposed interceptors would also provide sewage treatment service in areas where septic systems were allegedly failing and they would accommodate anticipated future growth in the Study Area. In addition to the proposed facilities, the 201 Plan concluded that no economically feasible means of serving the wastewater

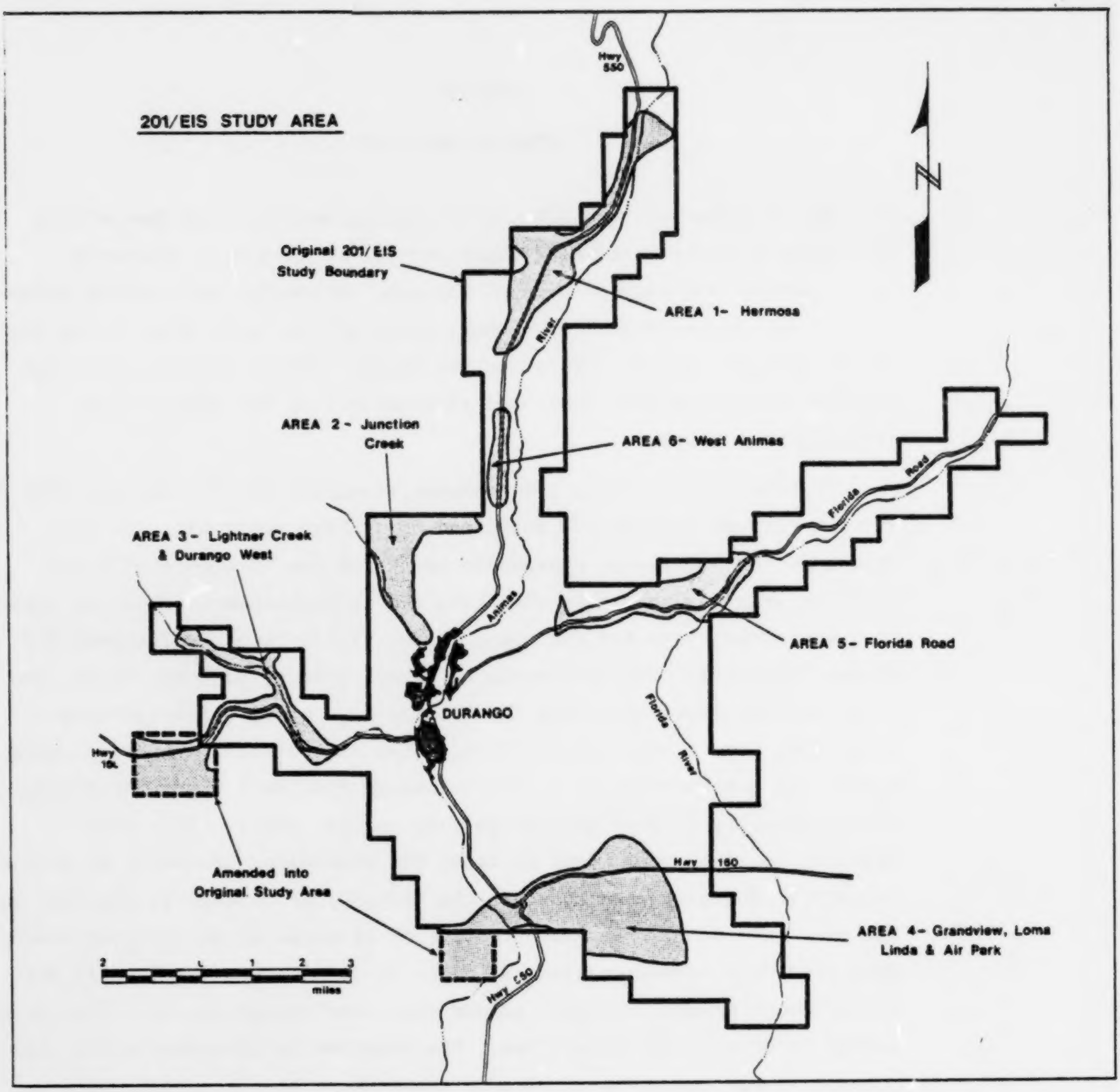
201/EIS STUDY AREA
Hwy 550
N
Original 201/EIS Study Boundary
AREA 1- Hermosa
River
AREA 2- Junction Creek
AREA 6- West Animas
AREA 3- Lightner Creek & Durango West
Animas
Florida Road
AREA 5- Florida Road
DURANGO
Florida River
Hwy 160
Hwy 160
Amended into Original Study Area
AREA 4- Grandview, Loma Linda & Air Park
Hwy 550
2 1 1 2 3
miles

FIGURE 2.1

needs of the Upper Florida River and the Florida Mesa portions of the Study Area exist.

EPA's review of the proposed facility plan revealed a number of significant issues that satisfied the regulatory criteria for preparation of an EIS (40 CFR Part 6.510). These issues arose primarily from the interceptors portion of the facility plan and they involved significant land use questions, conflicts with wildlife winter range, flood plains, historic and recreational resources (including the Denver and Rio Grande Narrow Gauge Railroad), induced growth and strip development. Additional concerns of the Study Area which are associated with the Facilities plan that have been identified include: water quality, land suitability for conventional septic tank systems, point source problems, air quality, economic costs, and growth rates and distribution patterns within the Animas Valley.

Six portions of the Study Area in which environmental issues are significant were identified. Maps of these areas which include features referred to in later chapters are presented in Figures 2.2 through 2.6. All of these areas are outside of the Durango City limits.

EPA determined that these areas needed to undergo further engineering, environmental, and economic analysis in a combined 201 plan update and environmental impact statement effort. This effort is aimed at assuring that the facility plan for the entire Study Area will be responsive to both local needs and EPA's environmental responsibilities.

In order to avoid delays in providing needed sewage treatment capacity for Durango, EPA, the City, and the Colorado State Health Department agreed in 1978 to modify the design/construction of a new sewage treatment plant while additional facility planning work and environmental analyses were being done. Work has proceeded with the design and specifications for a new 4.0 MGD plant, which should provide sufficient capacity to accommodate Durango's anticipated sewage treatment needs for an initial staging period. However, the City of Durango has undertaken a re-evaluation of the site and treatment process for the new plant. This re-evaluation study is independent of the EIS and 201 plan for the outlying areas, but it may affect certain alternatives being considered in the EIS.

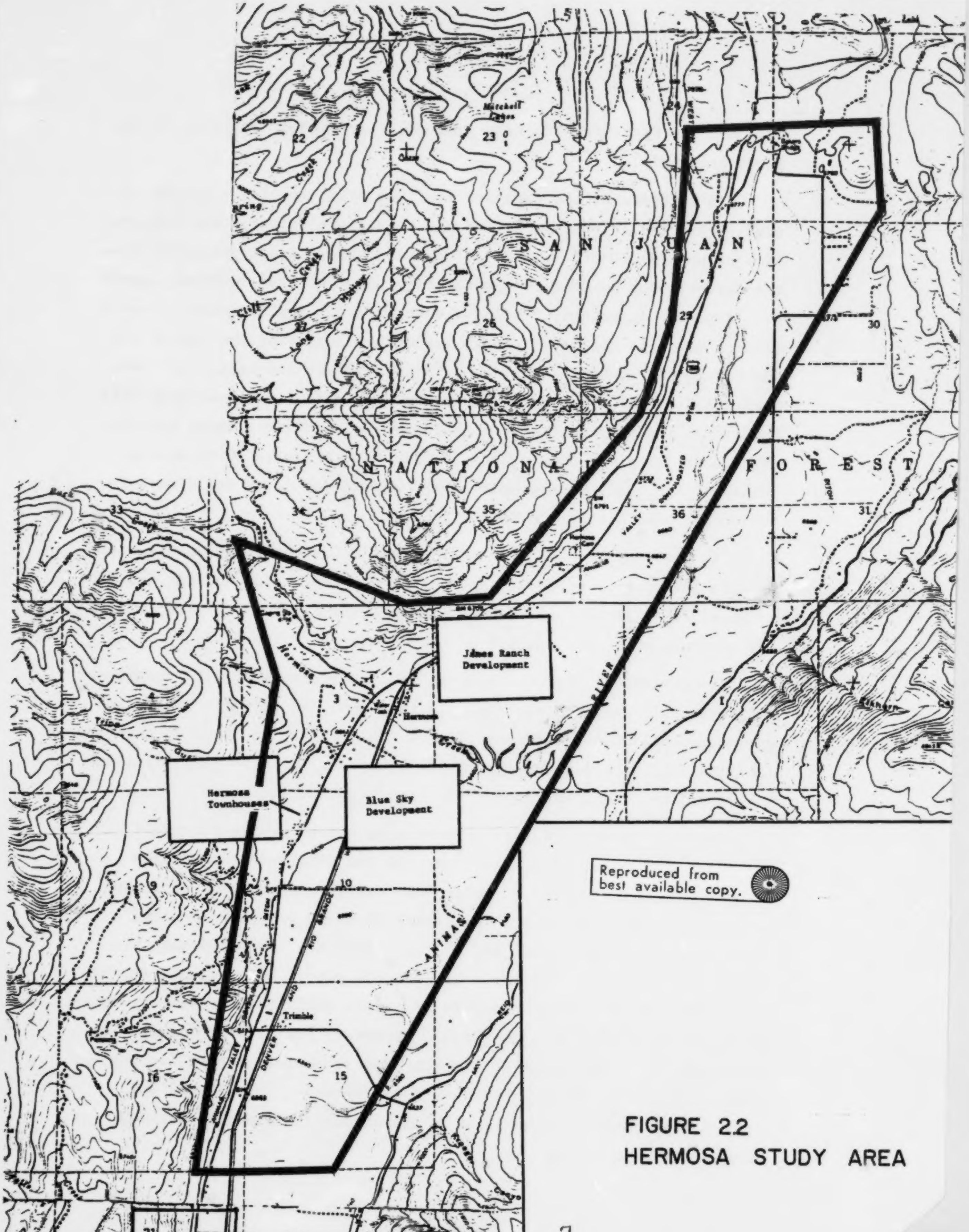
SAN JUAN
NATIONAL FOREST
Mitchell Lakes
James Ranch Development
Hermosa Townhouses
Blue Sky Development
Hermosa
Hermosa Creek
ANIMAS RIVER
Trimble
Long Hollow
Cliff Creek
DENVER AND RIO GRANDE
23
26
27
22
25
30
33
34
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FIGURE 2.2
HERMOSA STUDY AREA

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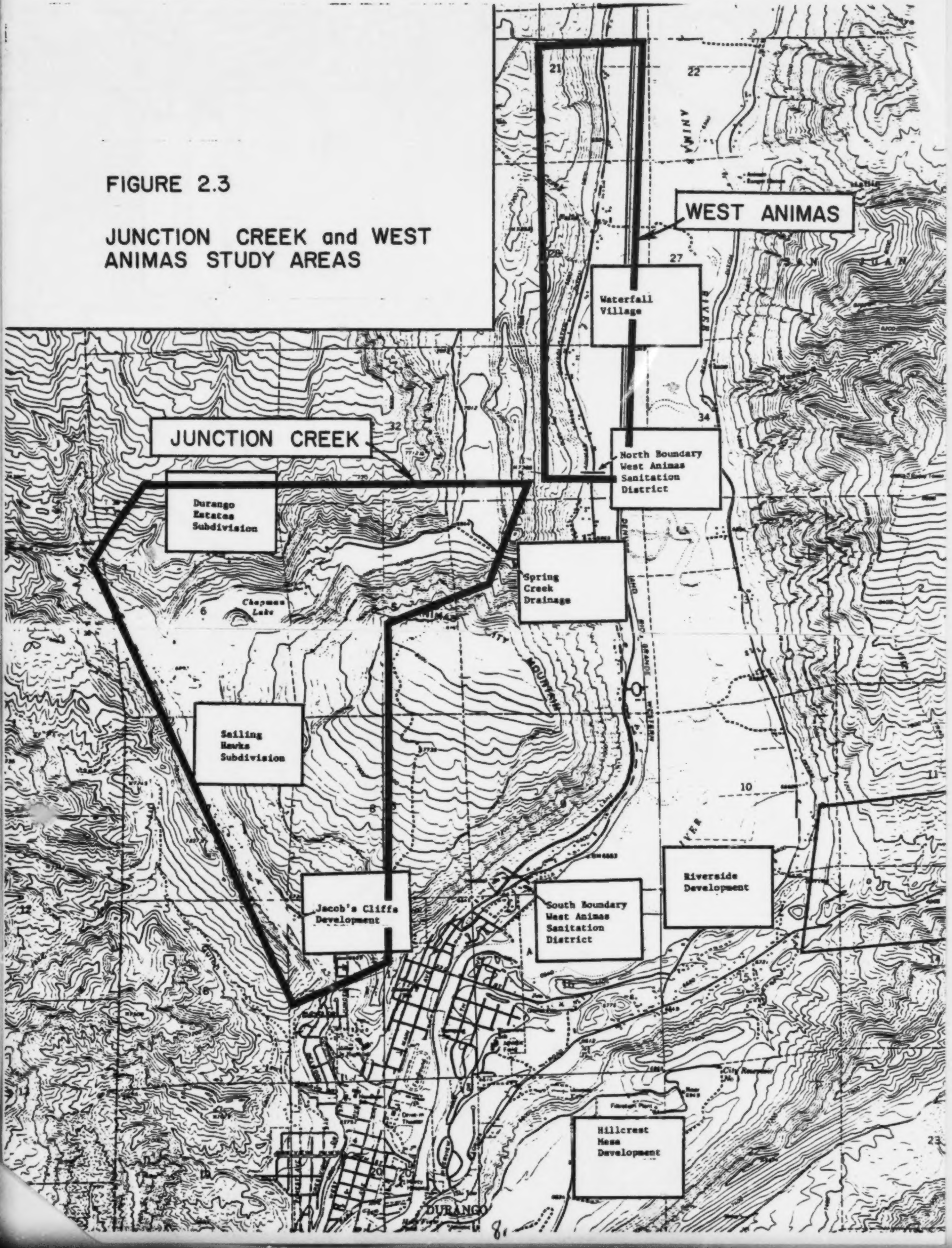

FIGURE 2.3

JUNCTION CREEK and WEST ANIMAS STUDY AREAS

WEST ANIMAS
Waterfall Village
JUNCTION CREEK
North Boundary West Animas Sanitation District
Durango Estates Subdivision
Spring Creek Drainage
Chapman Lake
Sailing Hawks Subdivision
Jacob's Cliffs Development
South Boundary West Animas Sanitation District
Riverside Development
Hillcrest Mesa Development
DURANGO
ANIMAS
RIVER
SAN JUAN
21
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10

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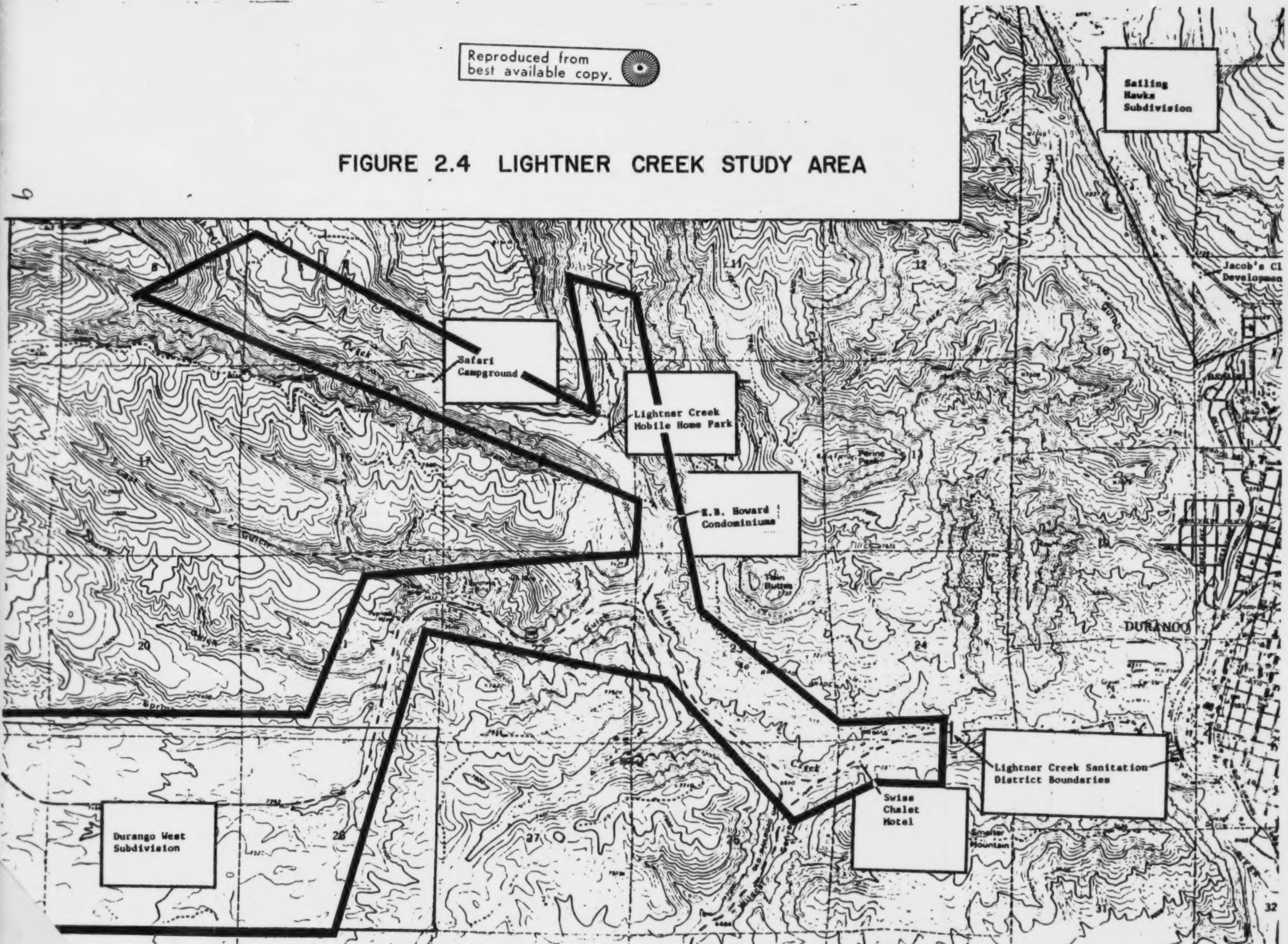
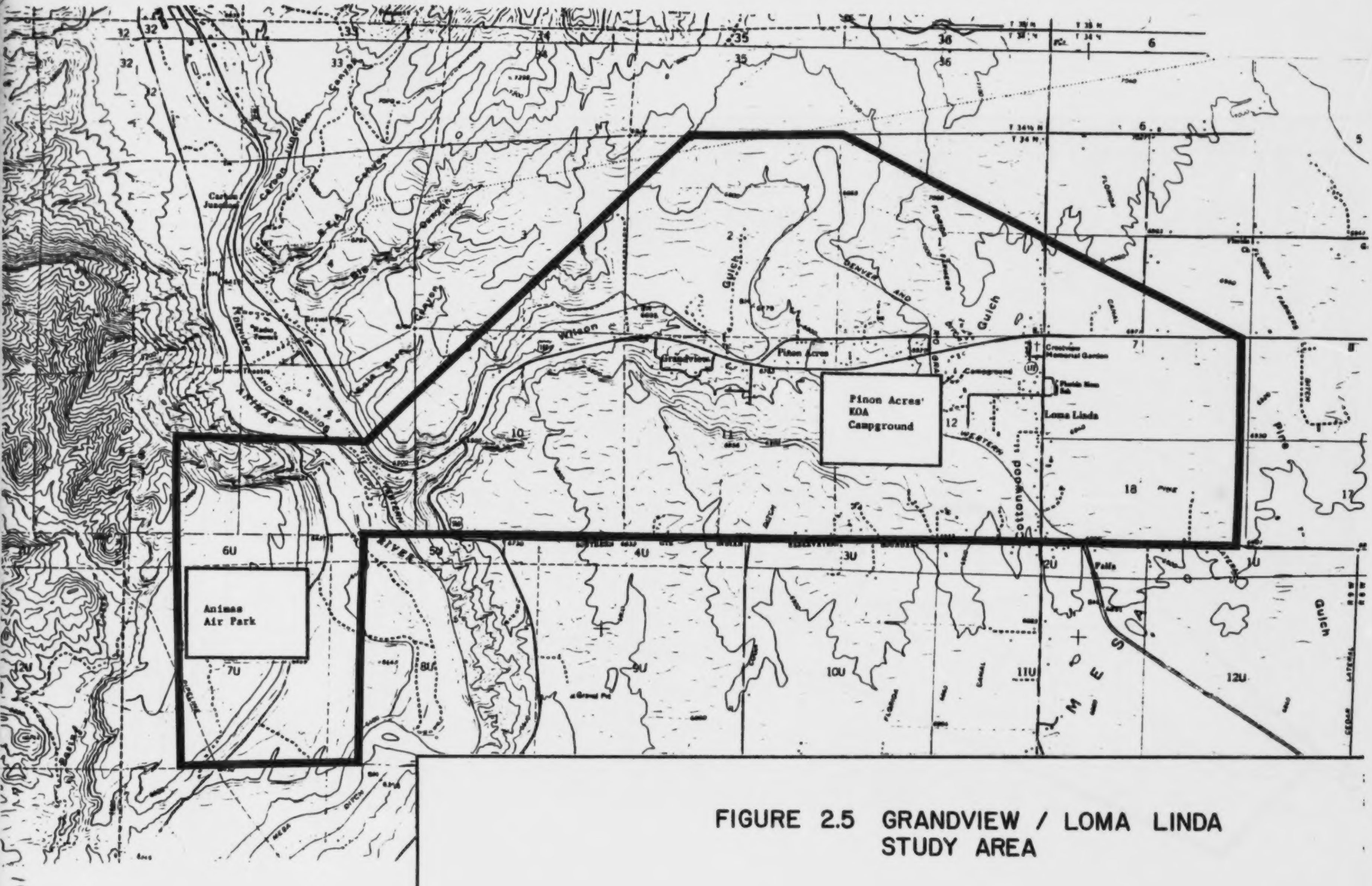

Sailing Hawks Subdivision
Jacob's Cl Developmen
Safari Campground
Lightner Creek Mobile Home Park
E.B. Howard Condominiums
Perins Peak
Twin Buttes
DURANGO
Lightner Creek Sanitation District Boundaries
Swiss Chalet Motel
Smelter Mountain
Durango West Subdivision
Creek
12
16
17
20
24
28
31
32
37

FIGURE 2.4 LIGHTNER CREEK STUDY AREA


Pinon Acres' KOA Campground
Animas Air Park
Loma Linda
Grandview
Pinon Acres
Wilson
Gulch
Cottonwood
Pine
Gulch
Carbon Junction
Denver and Rio Grande Western
Animas
River
Falls
M E S A
Campground
32
33
34
35
36
6
5
7
2
3
10
11
12
18
1U
2U
3U
4U
5U
6U
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12U

FIGURE 2.5 GRANDVIEW / LOMA LINDA STUDY AREA

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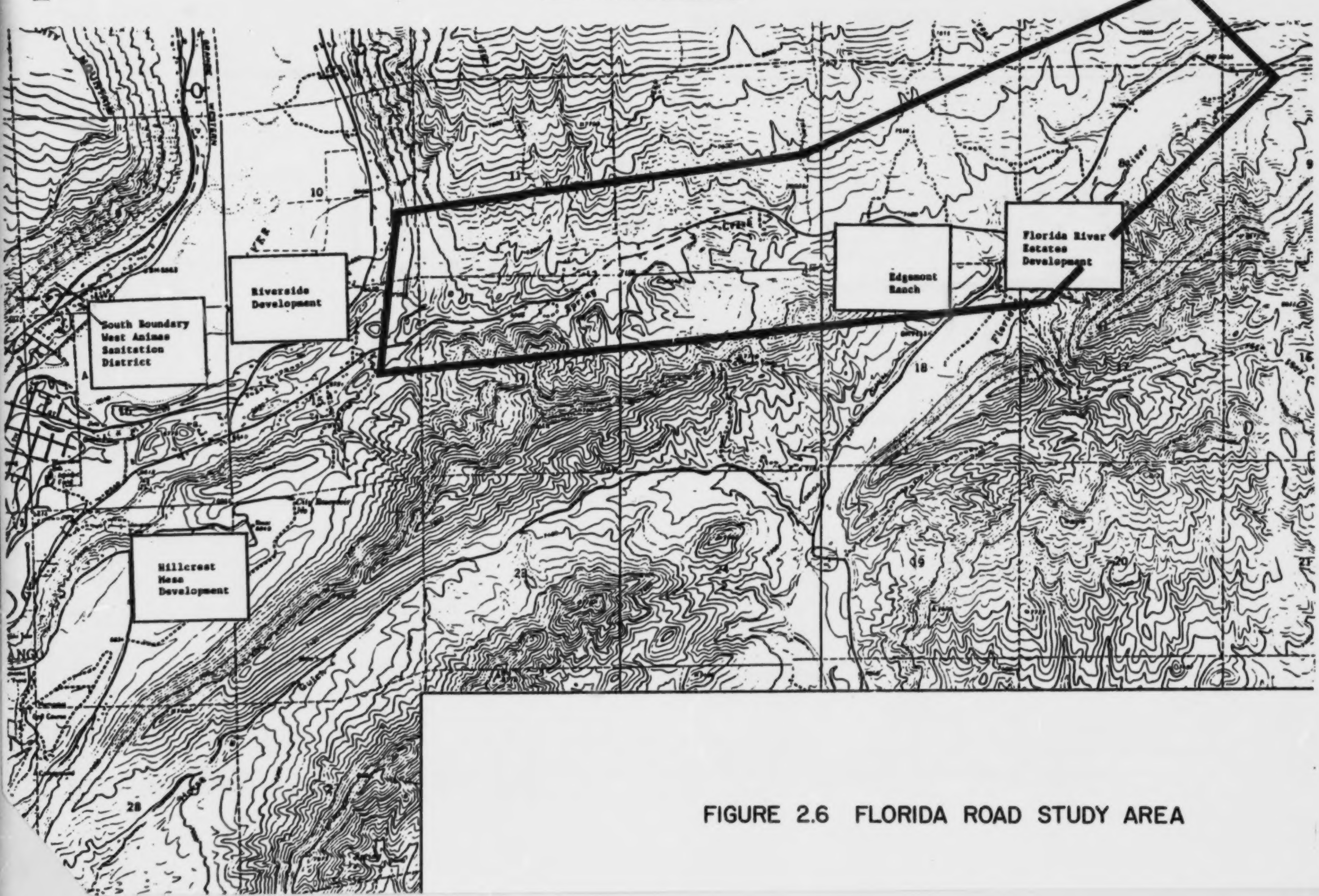
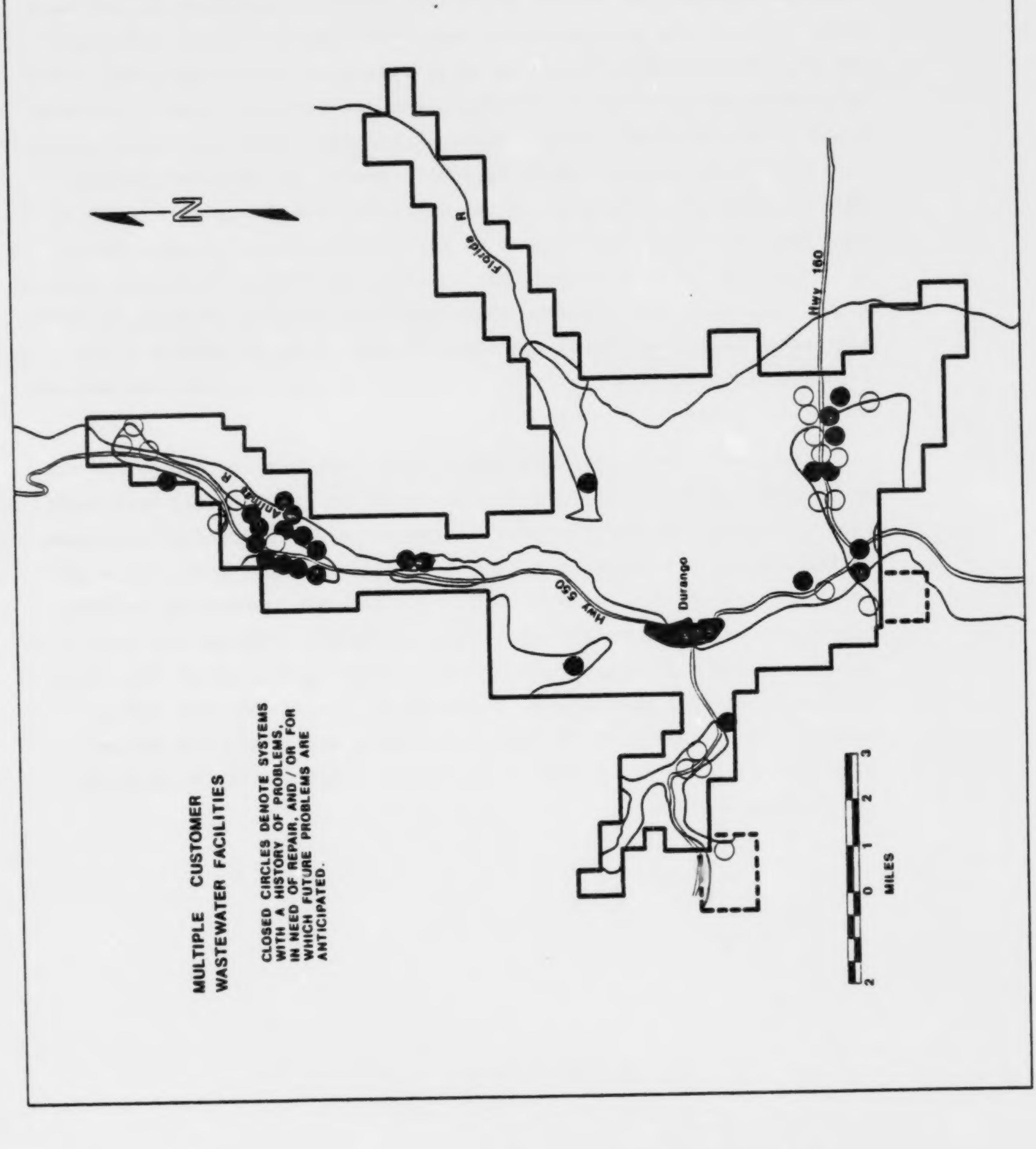

Florida River Estates Development
Edgemont Ranch
Riverside Development
South Boundary West Animas Sanitation District
Hillcrest Mesa Development
10
11
18
19
20
21
16
9
24
28
Florida

FIGURE 2.6 FLORIDA ROAD STUDY AREA

The need for this study stems from existing and/or anticipated problems arising from current wastewater handling practices in the Study Area. Some of the package plants have histories of recurrent failures and are intermittently degrading water resources in the area, especially in Hermosa and portions of Junction Creek and Lightner Creek. Continued reliance on individual on-site disposal systems, under increasing population pressures, poses a threat to public health and to water quality. This is especially important in the Grandview/Loma Linda area which is dependent on ground water resources for domestic water supply. Figure 2.7 shows the location of multiple customer wastewater facilities examined in the 201 study and indicates those with a history of problems or which the State Health Department considers to pose a future problem. The location and operation status of individual on-site disposal systems are shown in Figures 2.8 through 2.12.

One of the issues of the present study concerns whether or not the wastewater handling problems currently existing in the Study Area would best be solved through enforcement actions against individual violators or through the construction of new facilities. In the past, State and local enforcement actions have not been effective in assuring reliable operation, maintenance, and improvement of privately owned multiple customer systems (package plant systems receiving wastewater from more than one residence or business). Therefore, one of the underlying assumptions of this study is that enforcement and regulatory actions will not solve the water quality and public health problems posed by the failing systems.

FIGURE 2.7



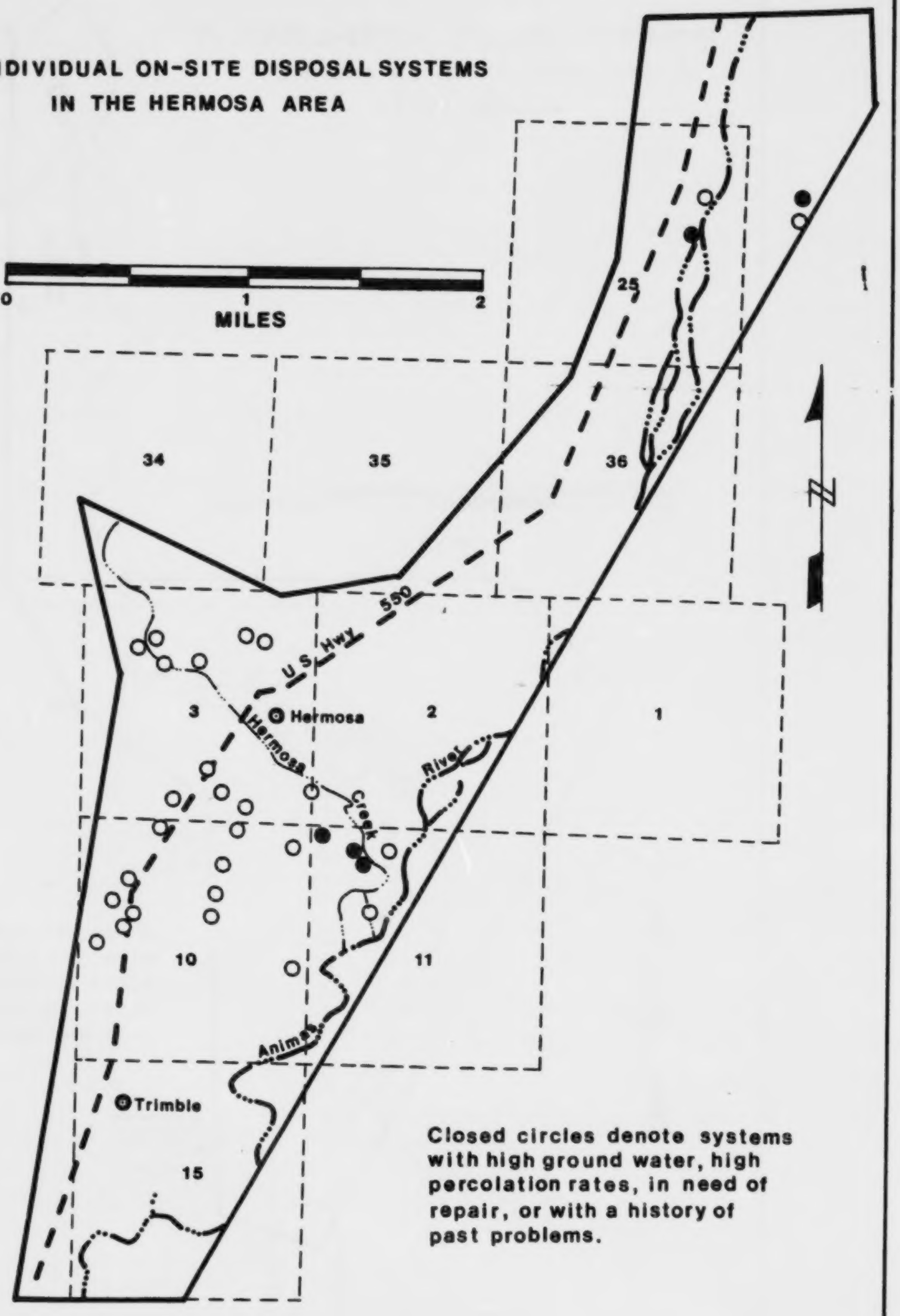
MULTIPLE CUSTOMER WASTEWATER FACILITIES

CLOSED CIRCLES DENOTE SYSTEMS WITH A HISTORY OF PROBLEMS, IN NEED OF REPAIR, AND / OR FOR WHICH FUTURE PROBLEMS ARE ANTICIPATED.

N
Florida R
Hwy 160
Animas R
Hwy 550
Durango
MILES
2
0
1
2
3

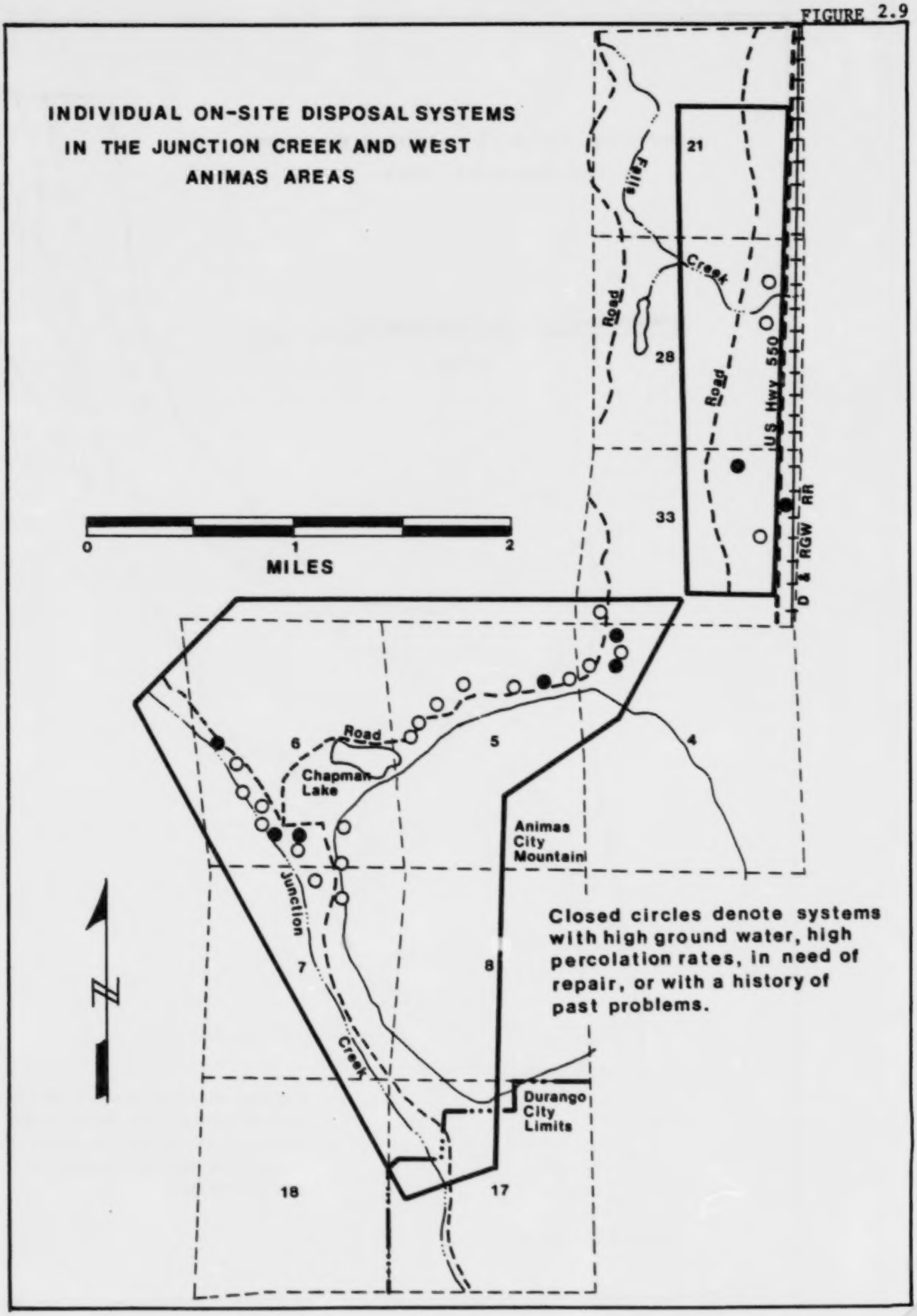
FIGURE 2.8

INDIVIDUAL ON-SITE DISPOSAL SYSTEMS
IN THE HERMOSA AREA


0
1
2
MILES
25
34
35
36
3
2
1
10
11
15
U.S. Hwy 550
Hermosa
Hermosa Creek
River
Animas
Trimble
N

Closed circles denote systems with high ground water, high percolation rates, in need of repair, or with a history of past problems.

FIGURE 2.9



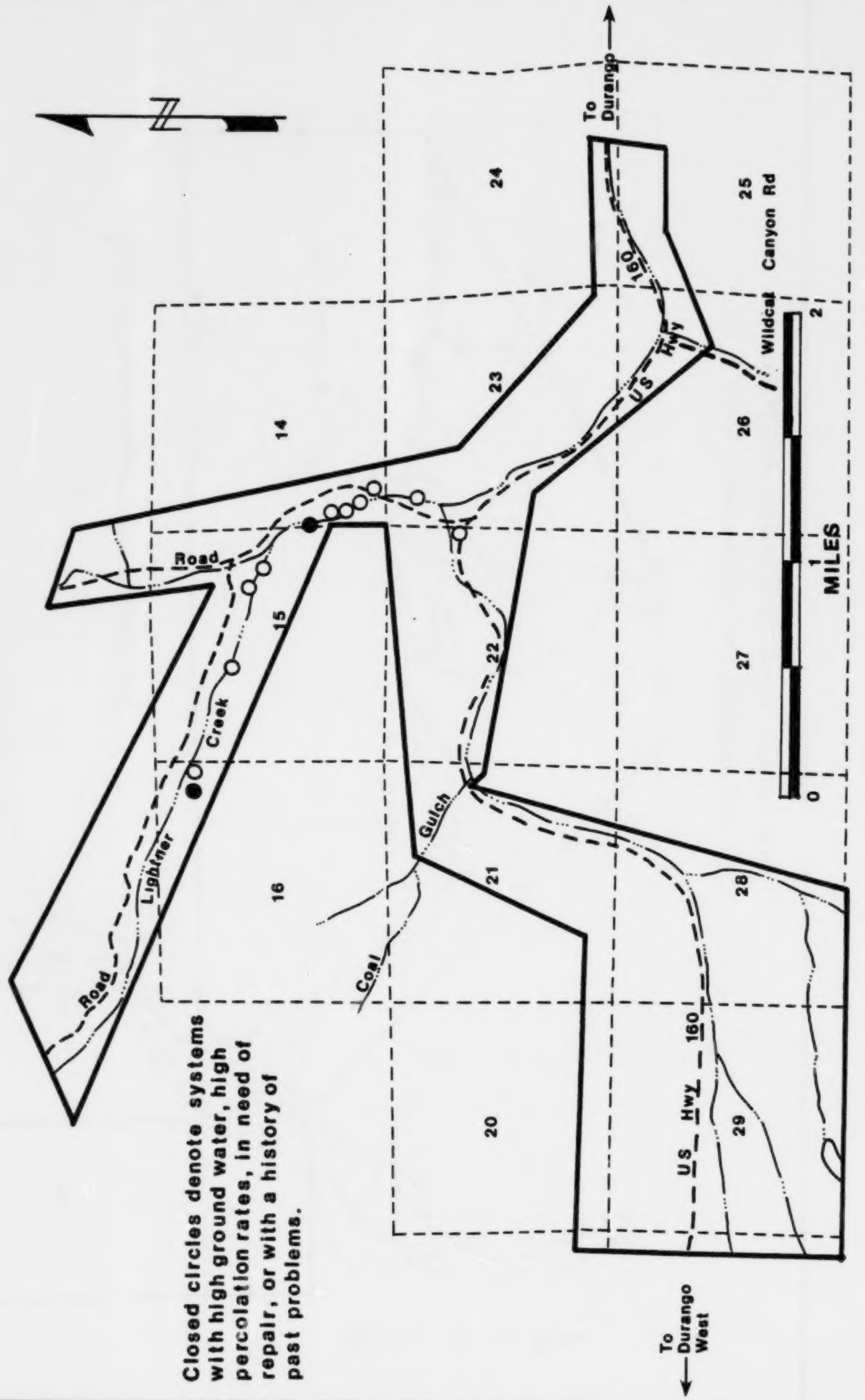
INDIVIDUAL ON-SITE DISPOSAL SYSTEMS IN THE JUNCTION CREEK AND WEST ANIMAS AREAS

Closed circles denote systems with high ground water, high percolation rates, in need of repair, or with a history of past problems.

0
1
2
MILES
N
21
28
33
Falls
Creek
Road
Road
US Hwy 550
D & RGW RR
6
5
4
Road
Chapman Lake
Animas City Mountain
Junction
Creek
7
8
Durango City Limits
18
17

FIGURE 2.10

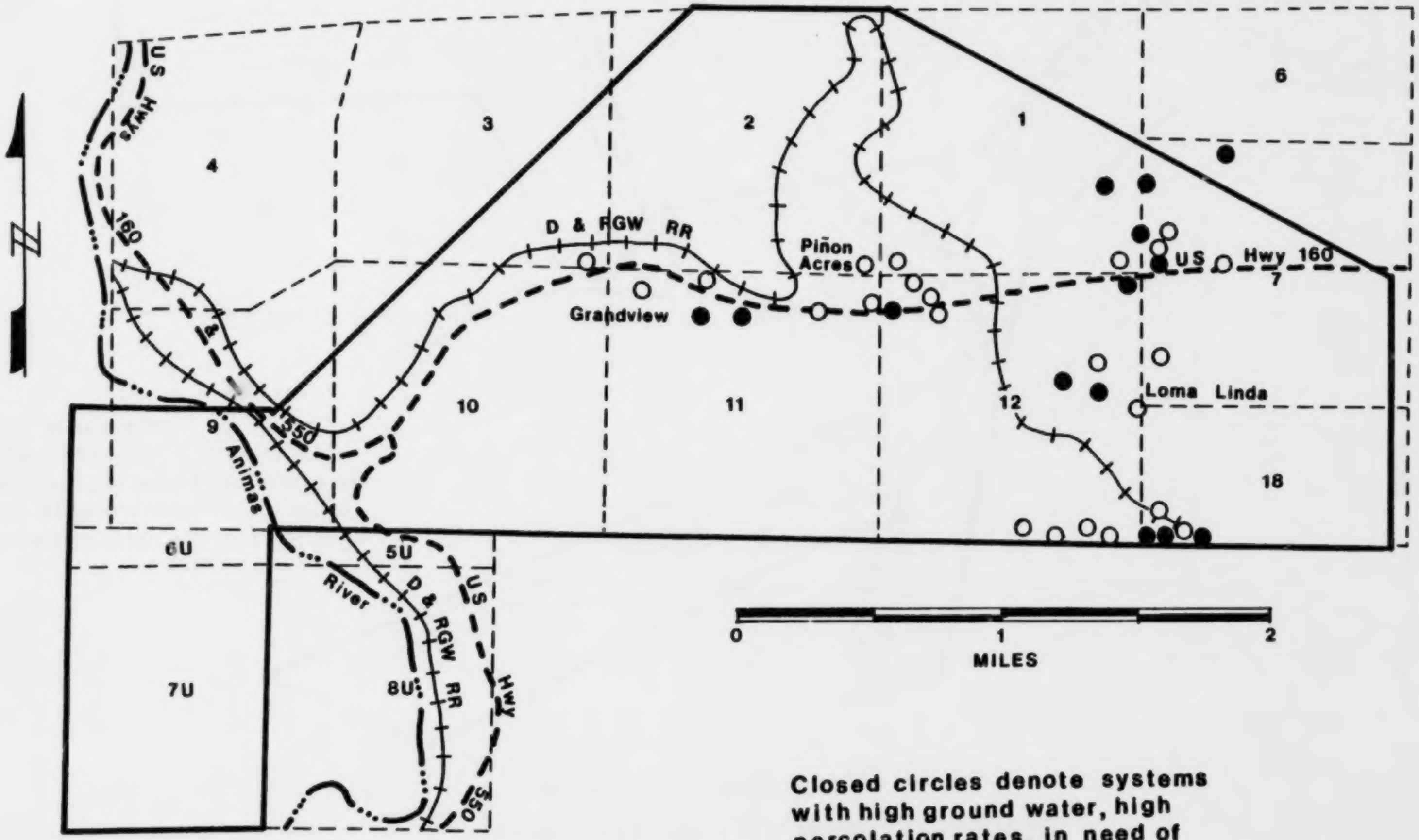
INDIVIDUAL ON-SITE DISPOSAL SYSTEMS IN THE LIGHTNER CREEK AREA


N
To Durango
24
25
Canyon Rd
Wildcat
160
US Hwy
23
14
26
Road
15
Creek
Lightner
Road
16
Gulch
Coal
21
22
0
1
2
MILES
27
28
160
US Hwy
29
20
To Durango West

Closed circles denote systems with high ground water, high percolation rates, in need of repair, or with a history of past problems.

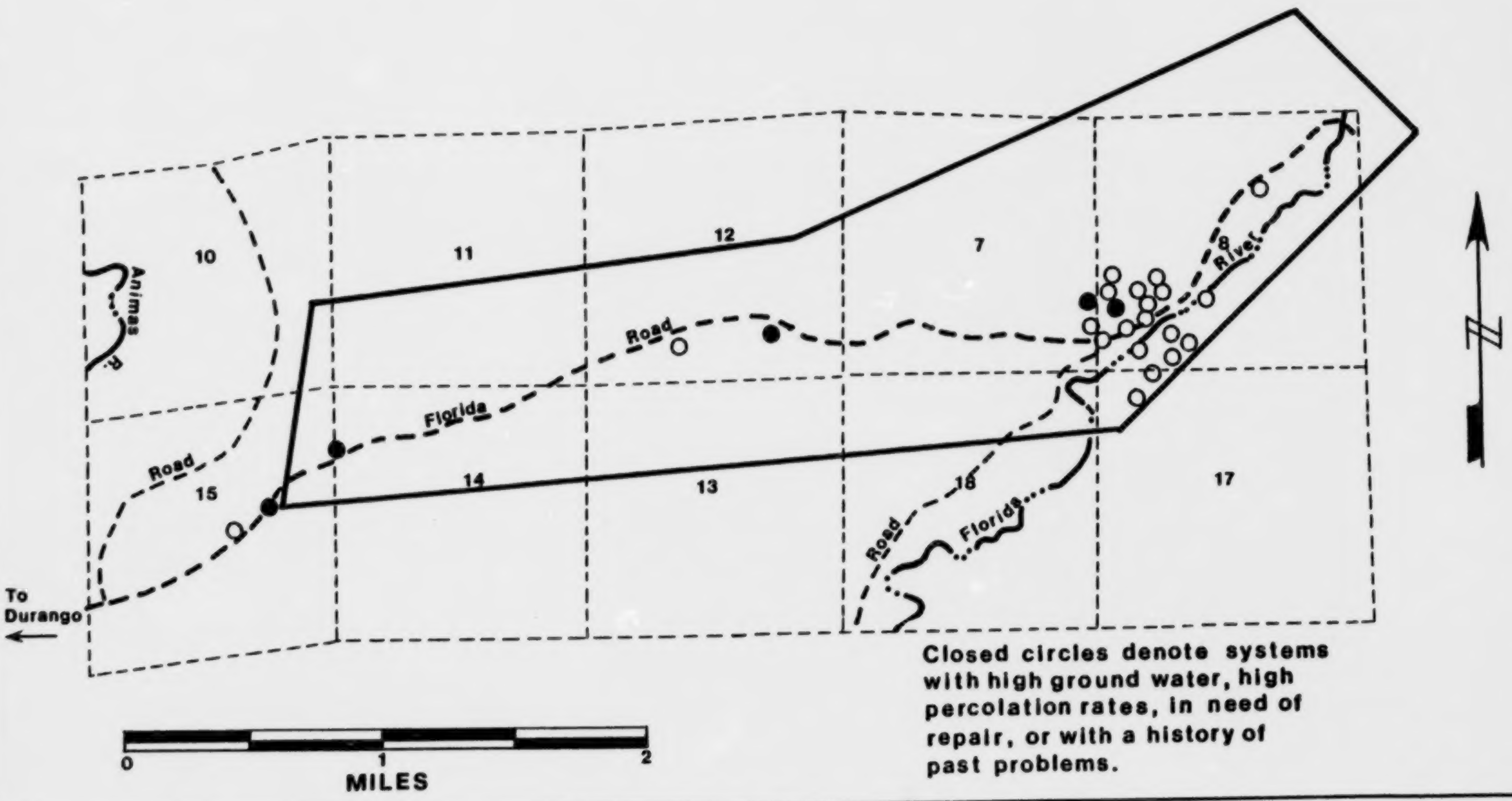
FIGURE 2.11

INDIVIDUAL ON-SITE DISPOSAL SYSTEMS IN THE GRANDVIEW / LOMA LINDA AREA


US Hwys 160
US Hwy 160
US Hwy 550
550
D & RGW RR
Animas River
Grandview
Piñon Acres
Loma Linda
1
2
3
4
6
7
9
10
11
12
18
5U
6U
7U
8U
N
0
1
2
MILES

Closed circles denote systems with high ground water, high percolation rates, in need of repair, or with a history of past problems.

INDIVIDUAL ON-SITE DISPOSAL SYSTEMS IN THE FLORIDA ROAD AREA


10
11
12
7
8
Animas R.
Road
Florida
Road
River
15
14
13
18
17
Road
Florida
To Durango
0
1
2
MILES

Closed circles denote systems with high ground water, high percolation rates, in need of repair, or with a history of past problems.

FIGURE 2.12

CHAPTER 3

DESCRIPTION OF ALTERNATIVES

PREVIOUSLY RECOMMENDED ALTERNATIVE

The original 201 Facilities Plan (HDR, 1977) recommended a centralized wastewater treatment facility for the Durango area and several interceptor sewer lines into the outlying areas to collect and convey wastewater. The original 201 Plan assumed that the Study Area boundary constituted an expansion of the Durango service area and therefore required that new interceptor sewers be provided to service these areas. The original recommended alternatives for the outlying areas consisted of several different interceptors. These interceptor sewers were to convey sewage from the outlying areas to the new treatment plant. The cost of these facilities was estimated at about $13,000,000 in 1977, and the yearly cost of operation and maintenance was about $400,000. The previously recommended facilities are summarized in Table 3.1 and illustrated in Figure 3.1.

In November 1979, Cap Allen Engineering was hired by the County with 201 grant funds obtained through the City to complete or update the Facilities Plan under the direction of a citizen's advisory group (CAG) established by the County. The results of the update are summarized below.

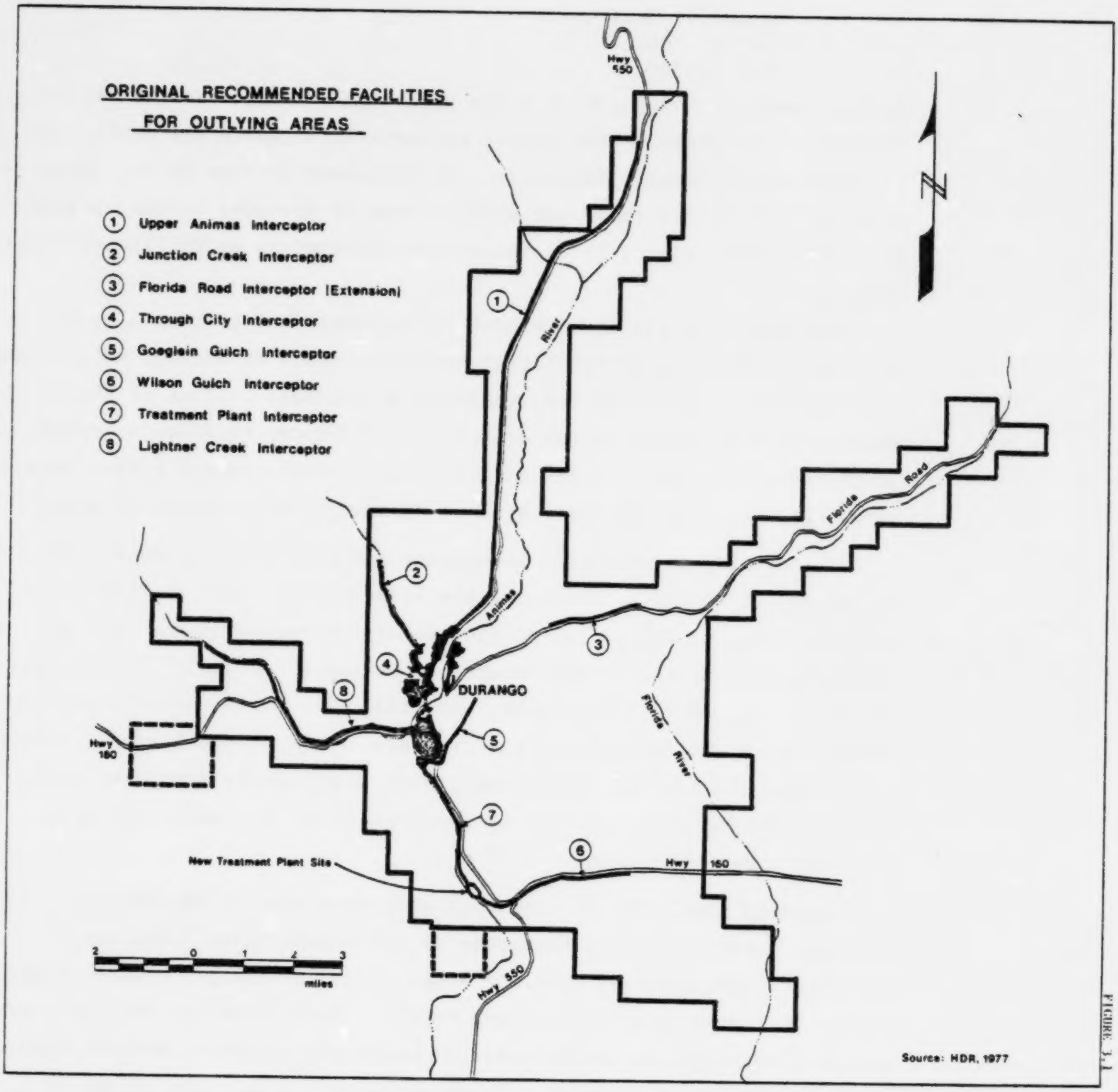
ALTERNATIVES CONSIDERED IN FACILITIES PLAN UPDATE

The update of the Durango Facilities Plan (Allen, 1980) examines the areas outlying the City of Durango in La Plata County for wastewater treatment requirements. The geographic limits of the update are smaller than the original 201 Study Area. The update focuses on confined population centers which, in the view of the CAG, are likely to develop pollution problems and wastewater treatment needs. Six specific areas of

TABLE 3.1

SUMMARY OF ORIGINAL RECOMMENDED ALTERNATIVES FOR OUTLYING AREAS

SERVICE AREA	INTERCEPTOR LENGTH(Ft.)	SIZE (Inches)	LIFT STATIONS(No.)	COMMENTS
Upper Animas - N. end of Durango to Baker's Bridge	64,000	8-12	3	Provides capacity for the area east of the Animas R. in the upper reaches more suitable for development.
Junction Creek - N.W. corner of Durango into Junction Creek drainage	10,000	8	0	Serves the Junction Creek drainage area.
Florida Road - N.W. corner of Durango along Florida Road to Animas R. drainage boundary	12,000	8	0	Serves development along Florida Road.
Wilson Gulch - From new treatment plant up Wilson Gulch along U.S. Highway 160	18,500	8	0	Serves the Grandview and Pinyon Acres areas.
Lightner Creek	Not presented	10-12	0	To be constructed by Lightner Creek Sanitation District.
Through-City - New areas of growth through City	19,000	21-27	0	-----
Goeglein Gulch - E. of Ft. Lewis College - golf course complex	9,000	10-12	0	Colorado Department of Health has deemed this as not grant eligible.


ORIGINAL RECOMMENDED FACILITIES FOR OUTLYING AREAS

① Upper Animas Interceptor
② Junction Creek Interceptor
③ Florida Road Interceptor (Extension)
④ Through City Interceptor
⑤ Goeglein Gulch Interceptor
⑥ Wilson Gulch Interceptor
⑦ Treatment Plant Interceptor
⑧ Lightner Creek Interceptor
N
Hwy 550
Animas River
Florida Road
DURANGO
Florida River
Hwy 160
New Treatment Plant Site
Hwy 160
Hwy 550
2 0 1 2 3
miles

Source: HDR, 1977

FIGURE 3.1

study are identified:

- Hermosa
- Junction Creek
- Lightner Creek
- Grandview/Loma Linda
- Florida Road
- West Animas

Because wastewater management needs vary widely among areas, a set of wastewater management alternatives and associated costs was developed for each area. These alternatives are discussed by area below. More detailed information about the alternatives is provided in the updated Facilities Plan (Allen, 1980) (hereafter referred to as Facilities Plan).

Hermosa

Wastewater in the Hermosa area is currently being treated by 19 multiple customer sewer facilities (package plants or aerated septic tank systems serving more than one residence or business). Four of these facilities are located in the area north of Hermosa to Baker's Bridge. Additional facilities consist of individual on-site septic tanks, aerated tanks, and evapotranspiration systems of various ages and conditions.

The principle wastewater management concern in the Hermosa area is the potential for pollution by the existing treatment facilities. Results of recent ground and surface water monitoring in the area are inconclusive. Indicator parameters of wastewater pollution do increase in the Animas River in this area, but still meet stream water quality standards. Large portions of the area are in the Animas River or Hermosa Creek flood plains, and springtime ground water levels are often near the surface; both of these can be constraints to successful operation of local treatment systems.

Package plants in the area typically discharge to ditches or drainage swales which are tributary to the Animas River. The low, irregular flows and high nutrient loads of the discharges create stagnant pools, with algal blooms in warmer months. This situation and the overloaded plants themselves can create nuisance odors and potential health problems at certain times of the year. These problems are slightly offset by the fact that the drinking water is supplied to the area by the Animas Water Company. However, this does not protect against the risk of exposure to disease-causing agents through ingestion or contact with polluted ditch or drainage water.

In the Hermosa area, increased building on existing lots will create conflicts in wastewater management in the area. The problem of pollution, while currently not acute, will likely increase with continued use of septic tank systems and proliferating package plants.

Five alternatives were proposed in the Facilities Plan for the Hermosa area. A brief summary of each of these alternatives is presented below.

Alternative 1 - Formation of Maintenance District

This alternative involves the formation of a Maintenance District. Its function would be to maintain and operate the package wastewater treatment plants in the area, and to monitor and help maintain septic tank systems. In addition, the District would have authority to approve specifications and maintenance requirements of future sewage facilities in the area.

Equipment needs of the District could include septage pumping equipment, water chemistry testing equipment, maintenance tools, and vehicles. At a minimum, the District would need a Class C certified wastewater treatment plant operator. The responsibilities of this individual would include record keeping, water sampling, monitoring of plant operations, and maintenance. Certain of the equipment needs would be eligible for 201 grant funding, but the costs of operation for the district would have to be borne locally.

Alternative 2 - Collection and Interceptor Lines to Durango

In this alternative, wastewater from the Hermosa area would be conveyed to Durango to be treated at the City of Durango wastewater treatment facility. It would involve laying an eight- to ten-inch interceptor line along the Animas Valley from the City of Durango system to Hermosa Creek. It would also require the construction of collectors in the Hermosa area, and three lift stations. In addition, the North Durango interceptors would have to be upgraded. The proposed interceptor lines for this alternative are shown in Figure 3.2

Alternative 3 - Central Wastewater Treatment Facility

In this option, a wastewater treatment facility would be built in the vicinity of Hermosa to serve the needs of the immediate area.

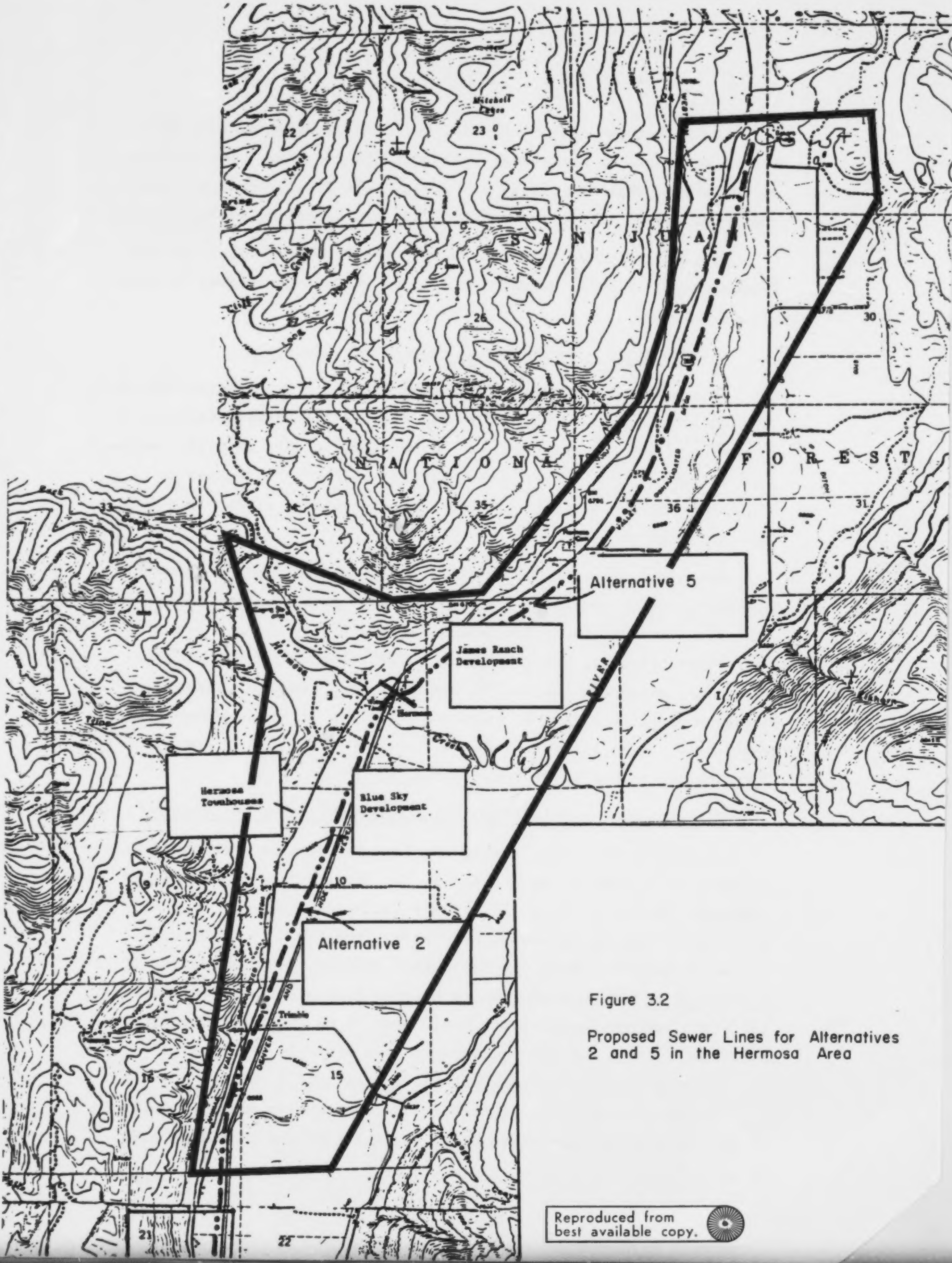

SAN JUAN
NATIONAL FOREST
Mitchell Lakes
Alternative 5
James Ranch Development
Hermosa Townhouses
Blue Sky Development
Alternative 2
Hermosa
Trimble
RIVER
Cliff
Creek
22
23
24
25
26
27
30
31
33
34
35
36
1
3
9
10
15
16
21
22

Figure 3.2

Proposed Sewer Lines for Alternatives 2 and 5 in the Hermosa Area

Reproduced from best available copy.

A 0.25 MGD aerated lagoon system is proposed to provide service to the area. Preliminary engineering indicates that a lagoon system which provides 3-day aeration, 8-day aeration, 2-day settling with comminution, a media filter and chlorination best meet the area's needs. This type of system avoids problems of sludge handling and disposal. Effluent discharge is to the Animas River. Two subalternatives associated with this plan include (1) modification of the aeration equipment to accommodate wind energy as a supplemental energy source and (2) land application of the treated effluent.

The wind energy and land application aspects of this alternative were determined not to be cost effective and eliminated from consideration during early stages of the planning process. Alternative 3 was selected in the Facilities Plan to be the recommended alternative. Three different configurations of sewer lines serving different portions of the Hermosa area were developed as subalternatives for Alternative 3 and are shown in Figure 3.3.

Alternative 4 - No Action

The No Action alternative is the continuance of the status quo.

Alternative 5 - Service Area Extension

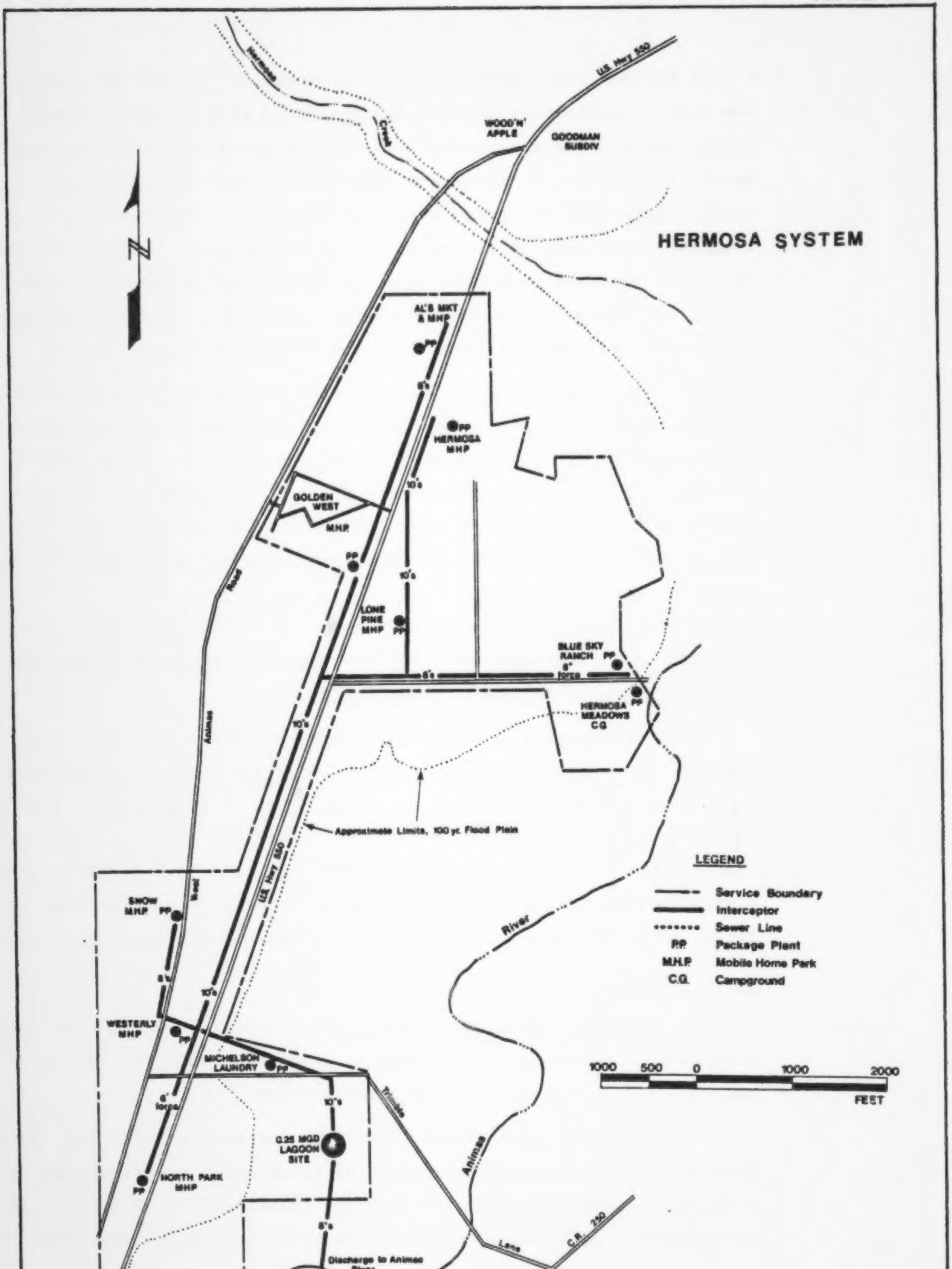
This alternative is essentially a sub-option to Alternatives 2 and 3. It would extend sewer lines in both of these Alternatives north from Hermosa to Baker's Bridge as shown in Figure 3.2. Lift stations would probably be required. Possible constraints to this option are that the area has a very low density of dwellings, and that two multiple-customer establishments in the area have recently built private treatment facilities which are expected to provide reliable service for a long period.

Junction Creek

The Junction Creek area currently has aerated septic tank systems with evapotranspiration beds or open evaporation ponds, and one package plant wastewater treatment system.

The Junction Creek Mobile Home Park owns and operates the single package plant. The system consists of an extended aeration unit followed by a clarifier, sand filters, and chlorination. Discharge is to Junction Creek. Wide variations in effluent quality and fluctua-

FIGURE 3.3


HERMOSA SYSTEM
N
Hermosa Creek
U.S. Hwy 550
WOOD'N' APPLE
GOODMAN SUBDIV
AL'S MKT & MHP
PP
8"s
HERMOSA MHP
10"s
GOLDEN WEST M.H.P.
Animas Road
LONE PINE MHP
BLUE SKY RANCH
8" force
Hermosa Meadows CG
Approximate Limits, 100 yr. Flood Plain
River
SNOW MHP
WESTERLY MHP
MICHELSON LAUNDRY
6" force
0.25 MGD LAGOON SITE
NORTH PARK MHP
Trimble Lane
Animas
C.R. 250
Discharge to Animas River
LEGEND
Service Boundary
Interceptor
Sewer Line
P.P. Package Plant
M.H.P. Mobile Home Park
C.G. Campground
1000
500
0
1000
2000
FEET

tions in stream flows create varying impacts on surface water quality.

The area east of Chapman Lake has a high water table and slow soil percolation rates. Lots in this area are less than three acres and therefore require evapotranspiration systems. Existing septic tank-leach field systems require constant monitoring to assure proper operation.

The area adjacent to Junction Creek has a very high water table and very rapid percolation rates. Effluent disposal systems associated with new construction in this area must be designed to operate properly under these conditions.

Six alternatives were proposed for the Junction Creek area. Each of these alternatives is briefly described in the following paragraphs.

Alternative 1 - Collection and Interceptor Lines to Durango

Under this option, an interceptor would be built to collect and convey wastewater generated in the Junction Creek area down the Junction Creek drainage to the City of Durango sewage treatment facility. Since the increased flows under this plan would overload existing sewer lines in northwestern Durango, the present interceptor in this part of the city would have to be replaced under this option to accommodate the increased flows. The approximate alignment of the proposed interceptor is shown in Figure 3.4.

Alternative 2 - Collection and Interceptor Lines to West Animas Sanitation District via Spring Creek

Wastewater from the Junction Creek area would be conveyed to the newly formed West Animas Sanitation District in the Animas River Valley under this alternative. Once within the District boundaries, wastewater would be conveyed to the City of Durango's wastewater treatment plant. The system would involve pumping the wastewater from the Junction Creek drainage over the low saddle into the Spring Creek drainage. This alternative would provide service only to the Chapman Lake area and the upper reaches of the Junction Creek drainage. Service would not be provided to Junction Creek Trailer Park. Figure 3.4 shows the approximate location of the proposed pipeline.

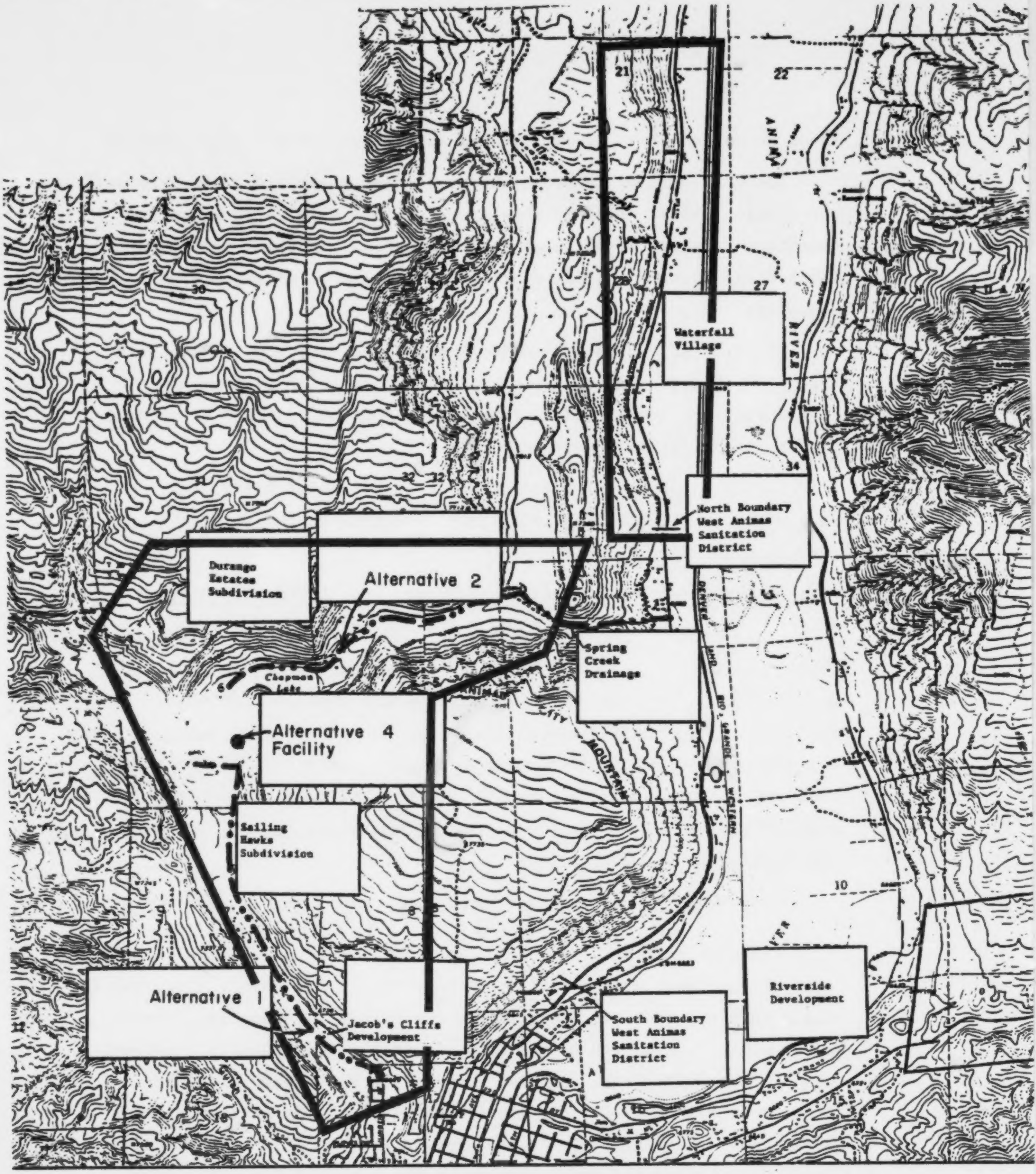

21
22
27
34
Waterfall Village
North Boundary West Animas Sanitation District
Durango Estates Subdivision
Alternative 2
Spring Creek Drainage
Chapman Lake
Alternative 4 Facility
Sailing Hawks Subdivision
10
Alternative 1
Jacob's Cliffs Development
South Boundary West Animas Sanitation District
Riverside Development
RIVER

Figure 3.4. Proposed Sewer Alignment for Alternatives 1 and 2 and Proposed Treatment Facility Location for Alternative 4 in the Junction Creek Area.

Alternative 3 - Formation of a Maintenance District

Under this alternative, a local sewage treatment facility would be built in the Chapman Lake area. The proposed Chapman Lake facility and the existing Junction Creek Trailer Park package plant would then be operated by the District. In addition, the District would monitor and help maintain on-site disposal systems in the area. The District would also have authority to approve specifications and maintenance requirements of future sewage facilities in the area.

Equipment and operational needs of the District would be similar to those discussed for the Maintenance District described for Hermosa.

Alternative 4 - Central Wastewater Treatment Facility

A centralized wastewater treatment system would be constructed to serve the Junction Creek drainage. Treatment would be provided by an aerated lagoon system and would serve Durango Estates Subdivision, Sailing Hawks Subdivision and other developments and single family residents. Service would not be provided to Junction Creek Trailer Park because of construction or operational costs to serve this one facility from the lagoon. The approximate location of the proposed wastewater treatment facility is shown in Figure 3.4.

Alternative 5 - Short Interceptor

A short interceptor would be constructed along Junction Creek from the Junction Creek Mobil Home Park to the City of Durango sewer system. This option would eliminate the package plant in the Junction Creek area which has a history of operation problems. This alternative was selected as the recommended plan and is shown in Figure 3.5.

Alternative 6 - No Action

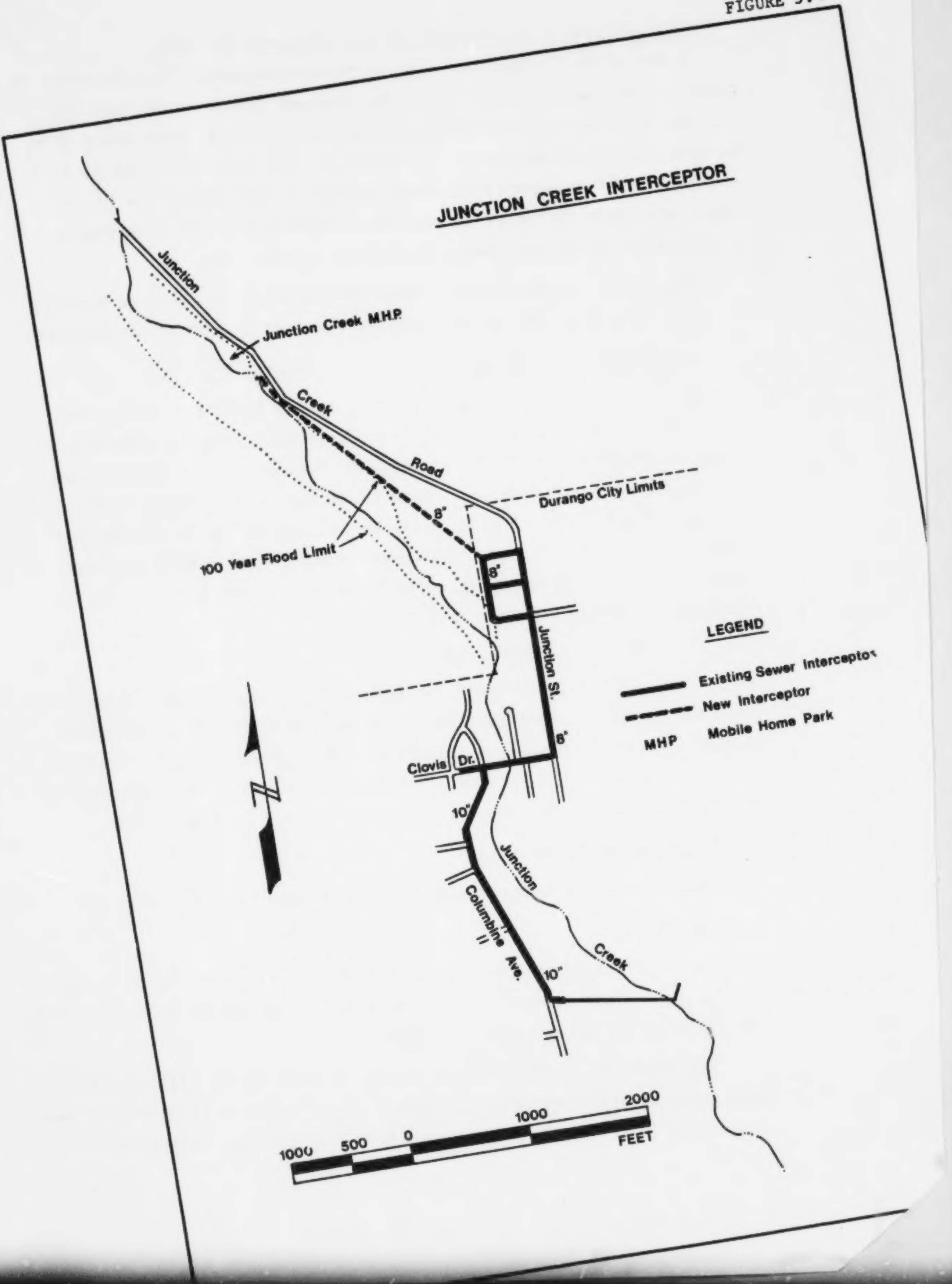
The No Action alternative is the continuance of the status quo.

Lightner Creek

The Lightner Creek area can be divided into three areas in terms of wastewater management strategies: 1) Swiss Chalet Motel, 2) County Road 207-the Lightner Valley, and 3) Durango West.

The Swiss Chalet Motel is located just west of the Lightner Creek Sanitation District boundary. Wastewater is currently treated by a septic tank-leach field system. The system does not show any indication of

FIGURE 3.5


JUNCTION CREEK INTERCEPTOR
Junction
Junction Creek M.H.P.
Creek
Road
Durango City Limits
8"
100 Year Flood Limit
8"
Junction St.
8"
Clovis Dr.
10"
Junction
Columbine Ave.
10"
Creek
N
LEGEND
Existing Sewer Intercepto
New Interceptor
MHP Mobile Home Park
1000 500 0 1000 2000
FEET

failing, but potentially could in the future (Allen, 1980). Critical features of the system which may aggravate a failure are land constraints, and high ground water and flooding due to proximity to Lightner Creek.

Three privately owned and operated wastewater treatment facilities are located in the Lightner Valley. E. B. Howard Condominiums operates a concrete three-cell aerated lagoon followed by land application. The Lightner Creek Mobile Home Park operates a 2-celled aerated lined lagoon with chlorination. The Safari Campground uses an extended aeration unit. All three of these systems are operated with limited problems. The greatest concerns are the relationship of domestic water supply intakes along Lightner Creek below discharges and the potential for flooding.

The Durango West subarea receives wastewater treatment from the Durango West Metropolitan District. The District operates a 100,000 gallon per day (GPD) extended aeration plant that has experienced startup problems. Discharge of the treated effluent is to the dry Coal Gulch drainage. The greatest impacts of this facility are associated with visual and odor problems in Coal Gulch. The discharged treated effluent is absorbed into the dry drainage bed and does not directly enter any surface waters.

Four alternatives for sewage treatment were proposed for the Lightner Creek/Durango West Study Area.

Alternative 1 - Collection and Interceptor Line to Durango

This alternative consists of building interceptor lines of various lengths up the Lightner Creek Drainage. Sewage from these areas would be treated at the City of Durango's wastewater treatment facility. All options under this alternative would include building an interceptor connecting to the existing Lightner Creek Sanitation District interceptor. This line presently ends about two miles west of the Durango City limits. Four different interceptor systems have been proposed, each serving a different portion of the proposed service area.

a. Interceptor Line to the Wildcat Canyon Road - This option would serve those users between the end of the present Lightner Creek Sanitation District and Wildcat Canyon Road. U.S. Highway 160 would have to be crossed to serve the Swiss Chalet Motel. Alternative 1 with this sewer line alignment was selected in the Facilities Plan as the recommended alternative and is shown in Figure 3.6.

b. Interceptor Line to Lightner Valley along Lightner Creek - This option would include extending the interceptor proposed in option "a" west to the divergence of Lightner Creek and U.S. Highway 160. It would consist of about 8,000 feet of interceptor laid through difficult terrain with very few users along its alignment. However, this line would be necessary to implement either options "c" or "d" under Alternative 1, as shown in Figure 3.7.

c. Interceptor to the Head of Development in Lightner Valley - The interceptors described in "a" and "b" would be extended northwest along Lightner Creek. This line would consolidate the users of three package plant type users plus private homeowners in the area. Approximate alignment is shown in Figure 3.7.

d. Interceptor Line to Durango West - The interceptor described in "a" and "b" would be extended westward to the Durango West community. This would be a very long interceptor with no services as it would pass through undevelopable land. A density of 1400 units would be necessary in Durango West for this project to be feasible. Proposed location of this interceptor is shown in Figure 3.7.

Alternative 2 - Formation of a Maintenance District

This alternative involves the formation of a Maintenance District. Its function would be to maintain and operate the package wastewater treatment plants in the area, and to monitor and help maintain septic tank systems. In addition, the District would have authority to approve specifications and maintenance requirements of future sewage facilities in the area.

Equipment and operational needs of the District would be similar to those described for the Maintenance District for Hermosa.

Alternative 3 - Central Wastewater Treatment Facility

Under this alternative wastewater flows in the Lightner Creek drainage would be conveyed to a central treatment facility in the basin. Treatment would be provided by an aerated lagoon followed by a discharge to Lightner Creek. The lagoon site would be at the Lightner Creek Road turnoff from U.S. Highway 160, as shown in Figure 3.7. The pipeline alignment would be the same as in Alternative 1-C, above.

Alternative 4 - No Action

The No Action alternative is the continuance of the status quo.

FIGURE 3.6

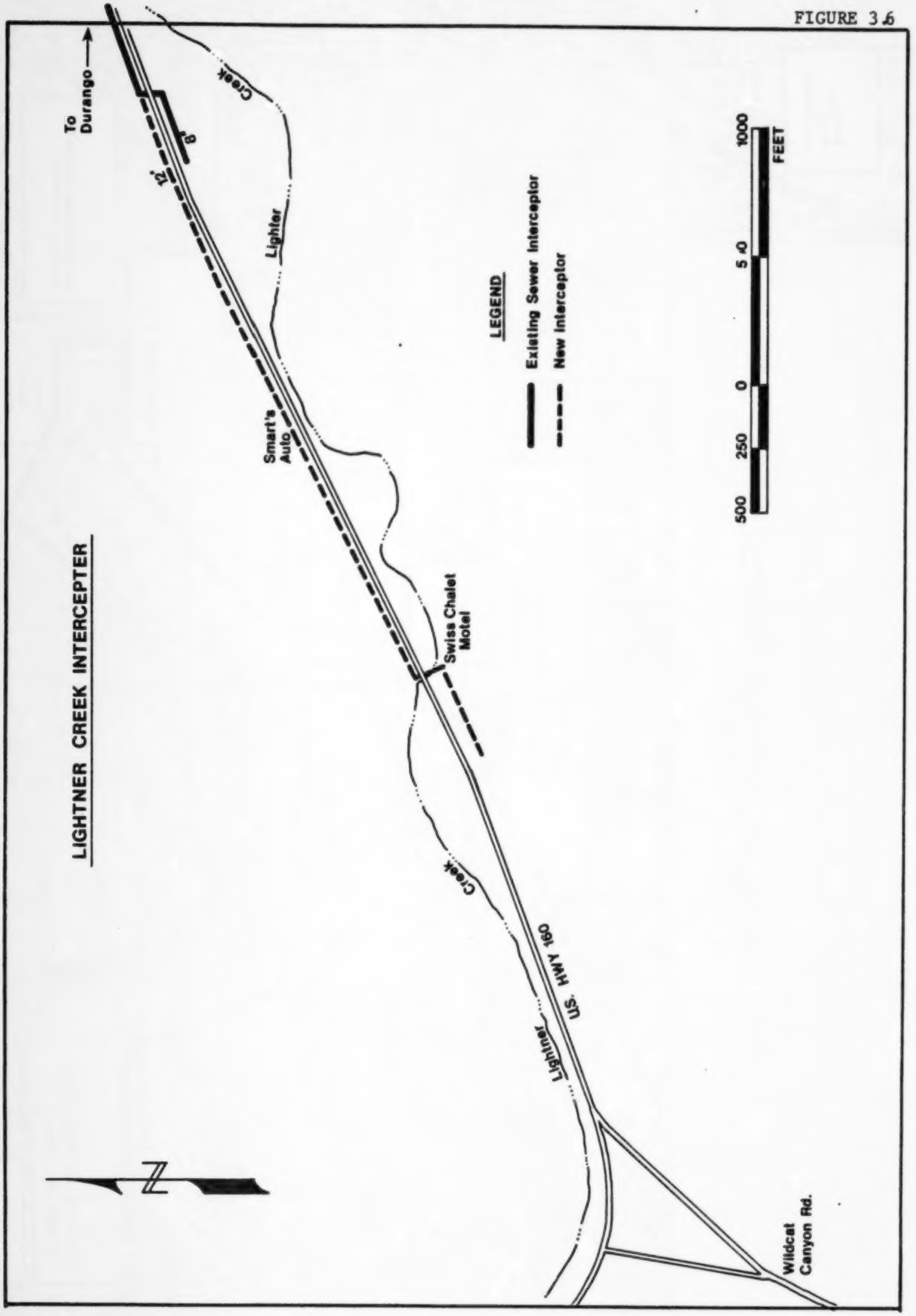
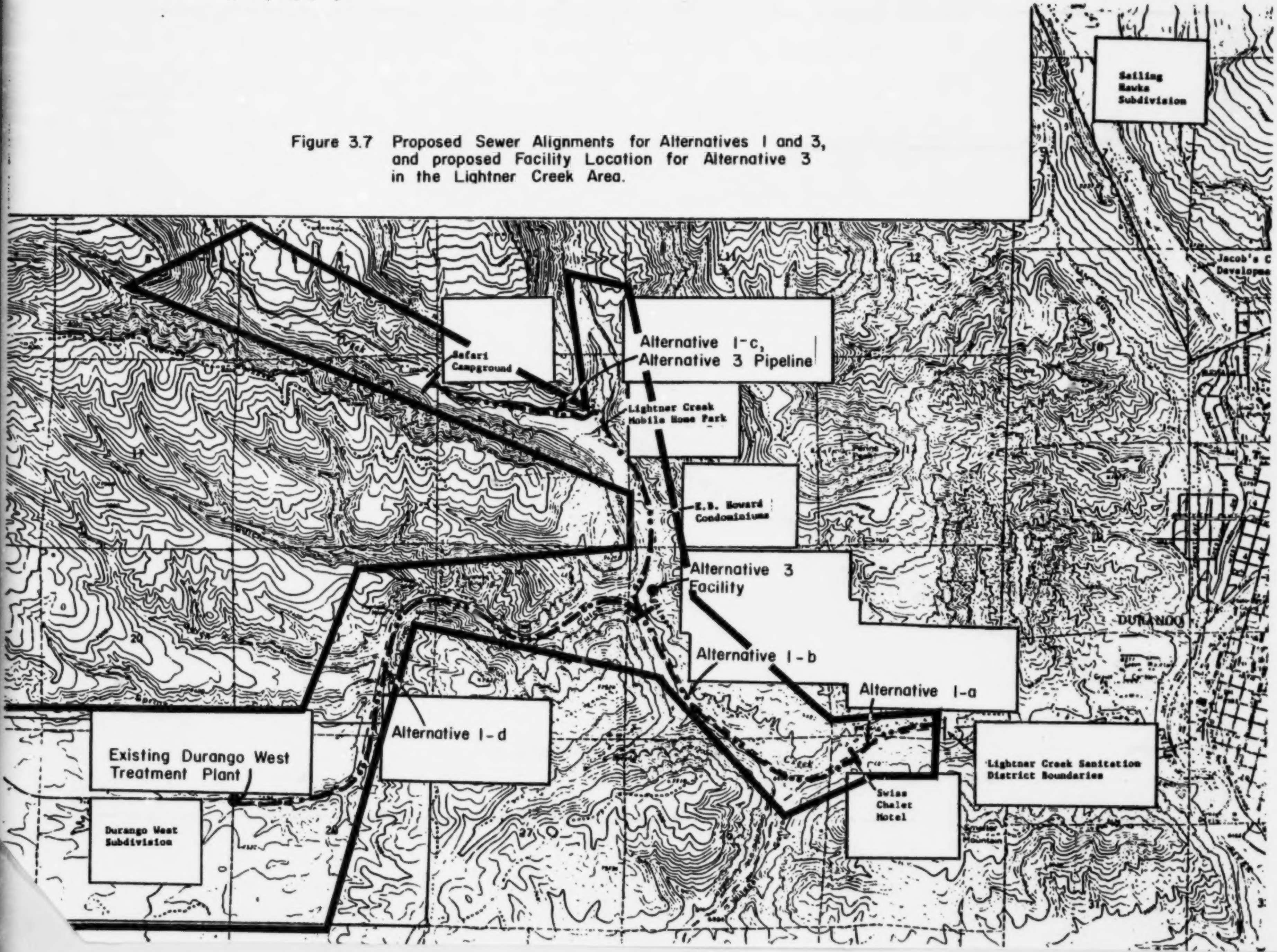

LIGHTNER CREEK INTERCEPTER
To Durango
12"
8"
Lightner
Creek
Smart's Auto
Swiss Chalet Motel
Lightner
Creek
U.S. HWY 160
Wildcat Canyon Rd.
N
LEGEND
Existing Sewer Interceptor
New Interceptor
500
250
0
500
1000
FEET

Figure 3.7 Proposed Sewer Alignments for Alternatives 1 and 3, and proposed Facility Location for Alternative 3 in the Lightner Creek Area.


Sailing Hawks Subdivision
Jacob's C Developme
Safari Campground
Alternative 1-c, Alternative 3 Pipeline
Lightner Creek Mobile Home Park
E.B. Howard Condominiums
Alternative 3 Facility
DURANGO
Alternative 1-b
Alternative 1-a
Lightner Creek Sanitation District Boundaries
Swiss Chalet Hotel
Alternative 1-d
Existing Durango West Treatment Plant
Durango West Subdivision
12
17
20
26
27
28

Grandview/Loma Linda

The Grandview/Loma Linda area is second only to Hermosa in the number of multiple customer wastewater treatment facilities.Other residential facilities utilize a multitude of systems ranging from septic tanks to aerated lagoons. The principal constraint to land disposal systems in the area is the tight clay soil of the Florida Mesa. This condition will perpetuate the use of surface effluent disposal techniques such as evapotranspiration ponds following septic tanks and package plants.

With the exception of irrigation ditches, there are no permanent drainages in the area. Discharges that have occurred from the existing holding ponds consist of 100 percent effluent. Odor and health effects become a critical concern in such instances. Odor and nuisance situations have also been noted in areas of high density due to poor maintenance schedules. Another concern is the dependency of the area on local well water for domestic water supply. Although no ground water pollution is evident at present, the soils in the area are such that cracks could develop under dry conditions thereby providing a means for inadequately treated wastewater discharged to lagoon or ditch systems to contaminate local aquifers.

Alternative 1 - Collection and Interception Line to Durango

This alternative consists of building collection systems and interceptor lines to various communities in the area. The interceptors would connect with the City of Durango system, and treatment would be at the City of Durango wastewater treatment facility. The feasibility of this alternative would be adversely impacted if the new Durango treatment plant is not built at the site proposed in the original Facilities Plan prepared by HDR. Various proposed pipeline configurations for for this alternative are shown in Figure 3.8.

a. Interceptor line to Pinon Acres KOA Campground - This option would provide for an interceptor and collector system from the City of Durango sewage treatment plant through the Grandview and Pinon Acres areas to the Pinon Acres KOA campground. Because of land constraints along U.S. Highway 160, the interceptor corridor would be the abandoned Denver and Rio Grande Western Railroad right-of-way. A number of collectors would be needed in this system due to the scattered nature of the present population. The interceptor would be sized to also accommodate use by the Loma Linda and Florida Mesa areas. A separate

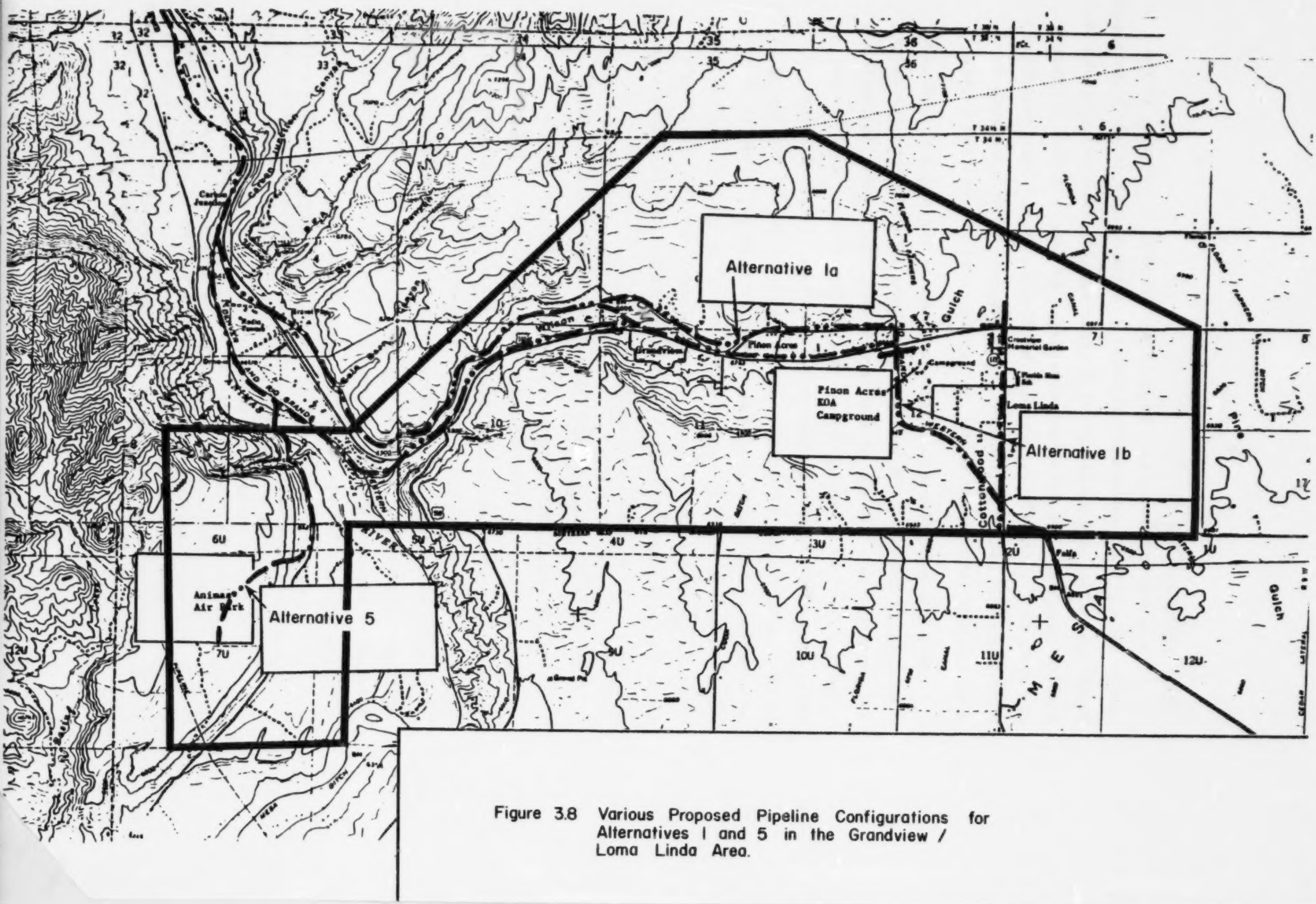

Alternative Ia
Alternative Ib
Alternative 5
Pinon Acres KOA Campground
Animas Air Park
Pinon Acres
Grandview
Loma Linda
Crestview Memorial Garden
Campground
Cottonwood
Gulch
Pine
Gulch
MESA
RIVER
32
33
34
35
36
6
7
8
10
11
12
17
1U
2U
3U
4U
5U
6U
7U
9U
10U
11U
12U

Figure 3.8 Various Proposed Pipeline Configurations for Alternatives I and 5 in the Grandview / Loma Linda Area.

sanitation district would be formed under this option.

b. Interceptor Line to Loma Linda and Florida Mesa - This option would extend the interceptor system proposed in option "a" into the Loma Linda and Florida Mesa areas. A gravity collection system could be used in the Loma Linda and Falfa areas, but a long force main would be required to move the sewage to the proposed Grandview/Pinon Acres interceptor. This option would provide central sewers to virtually the entire area. The abandoned Denver and Rio Grande Western Railroad right-of-way might be further utilized in this option.

Alternative 2 - Central Wastewater Treatment Facility - Loma Linda and Falfa Areas

A central aerated lagoon with associated interceptors and collectors would be built for the Loma Linda and Falfa areas under this alternative. A gravity feed system could be utilized to convey wastewater to the treatment facility. A local sanitation district would be formed for the area. This alternative was selected as the recommended plan to serve the Loma Linda area and is shown in Figure 3.9.

Alternative 3 - Central Wastewater Treatment Facility - Grandview and Pinon Acres Area

This alternative would provide for the construction of a central aerated lagoon with associated interceptors and collectors in the Grandview and Pinon Acres areas. A sanitation district for the area would be formed under this alternative. This alternative was selected as the recommended plan for the Grandview area and is shown in Figure 3.10. However, Grandview residents would still prefer to connect to the Durango system if the new Durango treatment facility is located at the site proposed in the original Facilities Plan prepared by HDR, which would eliminate the need for a central treatment plant at Grandview. Possible alignments connecting to the proposed Durango treatment plant are shown in Figure 3.11.

Alternative 4 - Formation of a Maintenance District

This alternative involves the formation of a Maintenance District. Its function would be to maintain and operate the package wastewater treatment plants in the area, and to monitor and help maintain septic

FIGURE 3.9

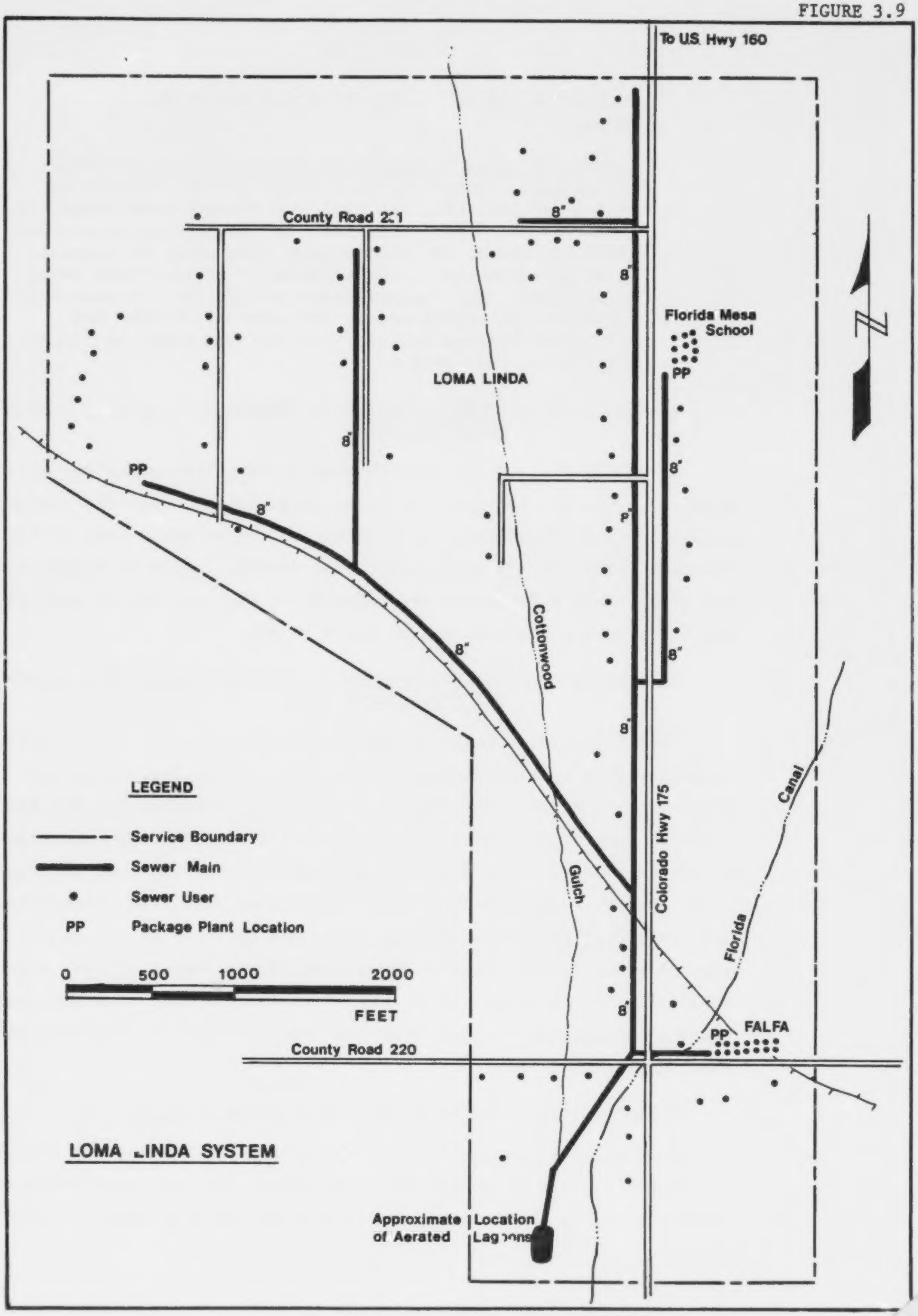
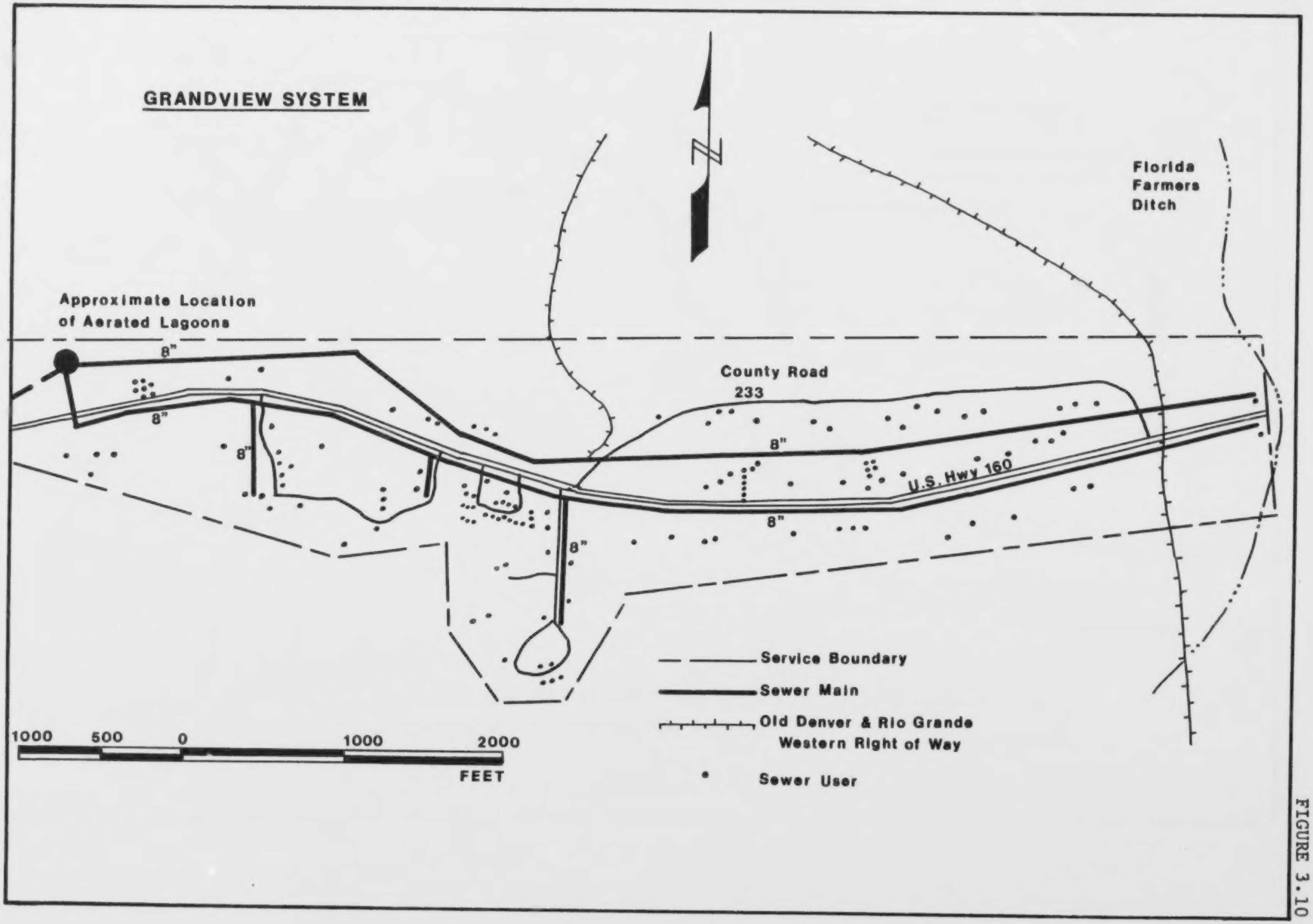
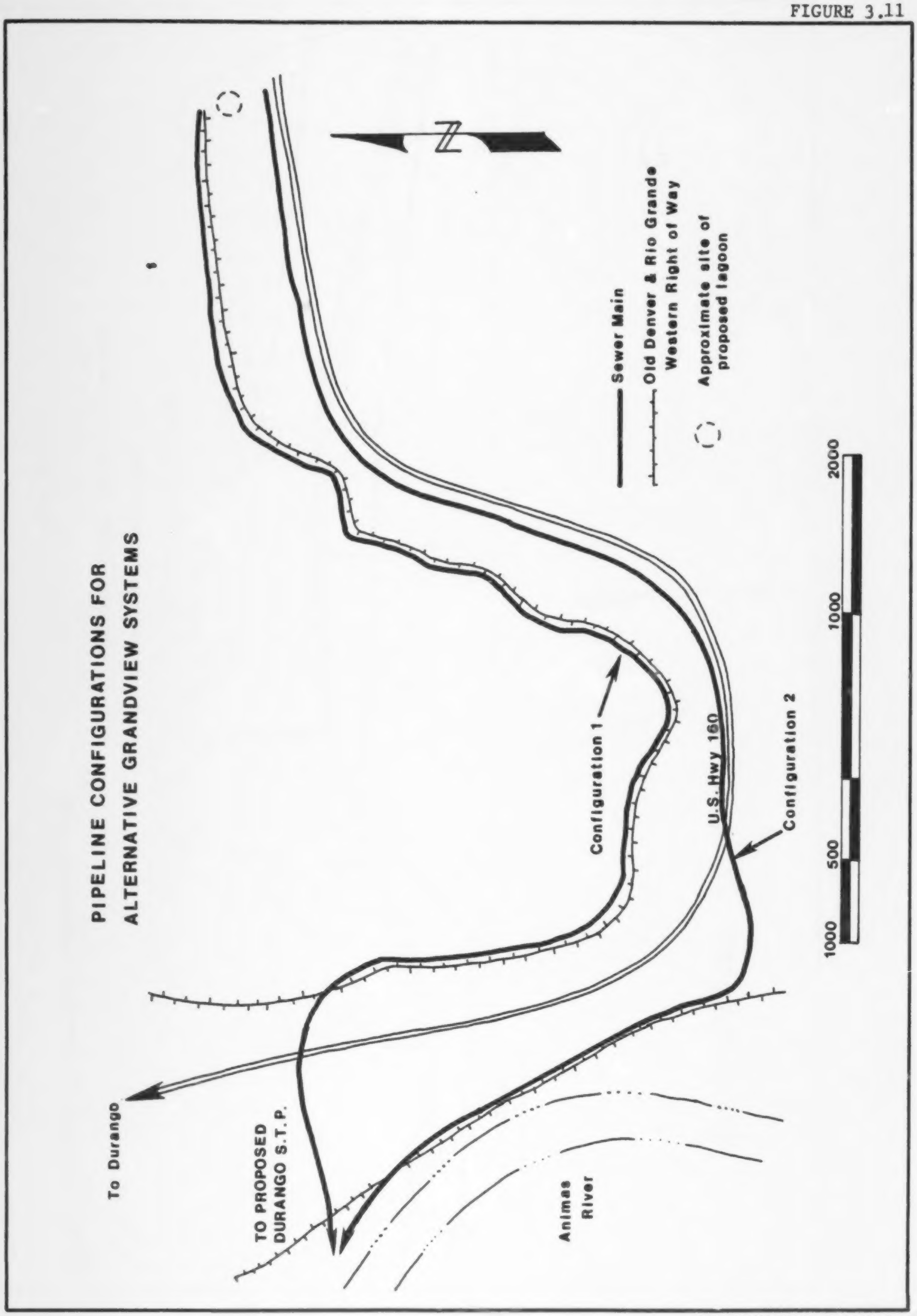

To U.S. Hwy 160
County Road 221
8"
Florida Mesa School
PP
LOMA LINDA
Cottonwood
Gulch
Colorado Hwy 175
Florida
Canal
FALFA
County Road 220
Approximate Location of Aerated Lagoons
LEGEND
Service Boundary
Sewer Main
Sewer User
PP Package Plant Location
0
500
1000
2000
FEET
LOMA LINDA SYSTEM

FIGURE 3.10


GRANDVIEW SYSTEM

Approximate Location
of Aerated Lagoons
8"
8"
8"
8"
8"
8"
County Road
233
U.S. Hwy 160
Florida
Farmers
Ditch
Service Boundary
Sewer Main
Old Denver & Rio Grande
Western Right of Way
Sewer User
1000
500
0
1000
2000
FEET

FIGURE 3.11


PIPELINE CONFIGURATIONS FOR
ALTERNATIVE GRANDVIEW SYSTEMS
N
Sewer Main
Old Denver & Rio Grande
Western Right of Way
Approximate site of
proposed lagoon
1000
500
1000
2000
Configuration 1
Configuration 2
U.S. Hwy 160
To Durango
TO PROPOSED
DURANGO S.T.P.
Animas
River

ENGINEERING-SCIENCE

tank systems. In addition, the District would have authority to approve specifications and maintenance requirements of future sewage facilities in the area.

Equipment and operational needs of the District would be similar to those discussed for the Maintenance District for Hermosa.

Alternative 5 - Interceptor Line to Animas Air Park

This alternative is simply an extension of the interceptor system proposed in Alternative 1 into the Animas Air Park area. Treatment of sewage would be by the City of Durango wastewater treatment facility. The suggested pipeline configuration is shown in Figure 3.8.

Alternative 6 - No Action

The No Action alternative is a continuance of the status quo.

Florida Road

With one exception, wastewater in the Study Area is treated by individual on-site disposal systems. The systems vary widely, ranging from conventional septic tank-leach field systems to aeration tanks/evapotranspiration beds.

The B & C Mobile Home Park has a multiple customer aerated tank system with a large leach field. This system has experienced failures of the leach field and the aeration tanks have been inoperable. It has been recommended that this system be renovated at the owner's expense (Allen, 1980).

The Florida Road area has a wide range of soil types which generally require special consideration for septic tank systems. Along Florida Road tight Mancos shale clays occur which require evapotranspiration beds or oversize leach systems. In the Florida River Valley percolation rates are very rapid and high ground water represents an additional constraint. These conditions require special design considerations for new on-site wastewater disposal systems.

Five alternatives were proposed for the Florida Road Study Area.

Alternative 1 - Collection and Interceptor Lines to Durango

This alternative includes running an interceptor northeast from the end of the existing line at Timberline View Estates. The new line would run along Florida Road to the saddle top divide between the Florida River and the Animas River. An additional collection network would be required to provide service to areas north of Florida Road. Sewage would be treated by the City of Durango wastewater treatment facility. The proposed pipeline configuration is shown in Figure 3.12

Alternative 2 - Central Wastewater Treatment Facility

Under this alternative an aerated lagoon with a collection/interceptor system would be constructed to service the Florida River Valley. Wastewater treatment in the Animas River drainage of the Study Area would continue with existing systems. Proposed treatment plant and pipeline locations are shown in Figure 3.12.

Alternative 3 - Short Interceptor to Durango

This plan is an abbreviated version of Alternative 1 and involves extending the sewer interceptor from Timberline View Estates to the B & C Mobile Home Park as shown in figure 3.12. This interceptor would receive wastewater from all existing homes along Florida Road, the B & C Mobile Home Park, and residences in the immediate vicinity of the mobile home park. Sewage would be treated by the City of Durango wastewater treatment facility.

Alternative 4 - Formation of a Maintenance District

Certain improvements to existing wastewater treatment systems would be made under this alternative, particularly at the B & C Mobile Home Park. Future operation and maintenance would be coordinated with an area-wide or county-wide maintenance district upon its creation.

Equipment and operational needs of the District would be similar to those discussed for the Maintenance District for Hermosa.

Alternative 5 - No Action

Although this alternative was not analyzed in the Facilities Plan, it was selected as the recommended plan for the Florida Road area by the Citizens Advisory Group after a public meeting in the area. This alternative would continue the status quo.

West Animas

Existing wastewater treatment in the West Animas area is by individual treatment systems and by a non-discharging extended aeration

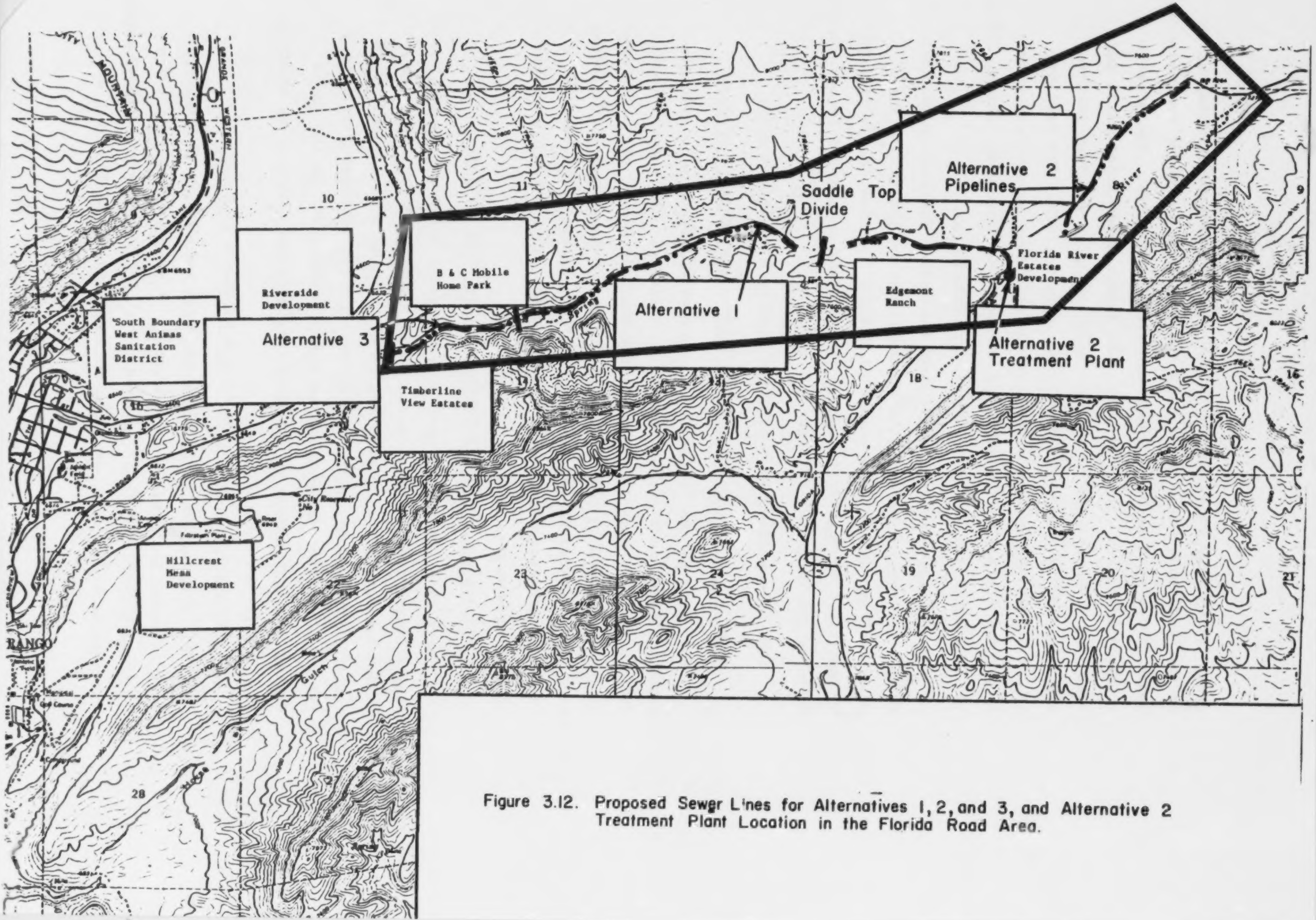

South Boundary West Animas Sanitation District
Riverside Development
Alternative 3
B & C Mobile Home Park
Timberline View Estates
Alternative 1
Saddle Top Divide
Edgemont Ranch
Alternative 2 Pipelines
Florida River Estates Development
Alternative 2 Treatment Plant
Hillcrest Mesa Development
10
11
16
18
19
20
21
23
24
28
9
RANGO

Figure 3.12. Proposed Sewer Lines for Alternatives 1, 2, and 3, and Alternative 2 Treatment Plant Location in the Florida Road Area.

plant followed by an oxidation ditch. The existing residential units in the West Animas area are fairly old and it is suspected that several leach fields need to be upgraded to current standards. The area is constrained for on-site systems by the Animas River flood plain and high ground water. The Lazy-U-Rancho operates an extended aeration plant followed by a non-discharging oxidation ditch. The facility is overloaded and 24-hour summer blower operation is required simply to prevent odors, with a resulting low level of treatment (Allen, 1980), and high operating costs due to energy consumption.

The recently created West Animas Sanitation District provides a sewer interceptor line into the southern edge of the area. This sewer line has an ultimate volume of 0.4 MGD and thus is not limited by capacity. There are also plans to construct an aerated lagoon system to serve the Waterfall Village.

Four alternatives were proposed for the West Animas area.

Alternative 1 - Collection and Interceptor Lines to Durango

This alternative proposes inclusion of the Study Area into the recently formed West Animas Sanitation District. The sewer interceptor line that presently ends at the southern end of the Study Area would be extended to north of Falls Creek. At least one lift station would be required on the new interceptor. Sewage would be treated by the City of Durango wastewater treatment facility. Possible alignment of this interceptor is shown in Figure 3.13.

Alternative 2 - Central Wastewater Treatment Facility

There is an immediate need for wastewater treatment at the Waterfall Village Condominium project. This alternative would provide this needed service with the construction of a new aerated lagoon. This facility would be sized to also accommodate the wastewater flow from the Lazy-U-Rancho camper park and other developments in the Falls Creek area. Approximate location of this proposed facility is shown in Figure 3.13.

Alternative 3 - Formation of a Maintenance District

This alternative would place the West Animas area in a county-wide or area-wide wastewater management maintenance district. The proposed Waterfall Village aerated lagoon and the existing Lazy-U-Rancho extended aeration plant would be included within the District's

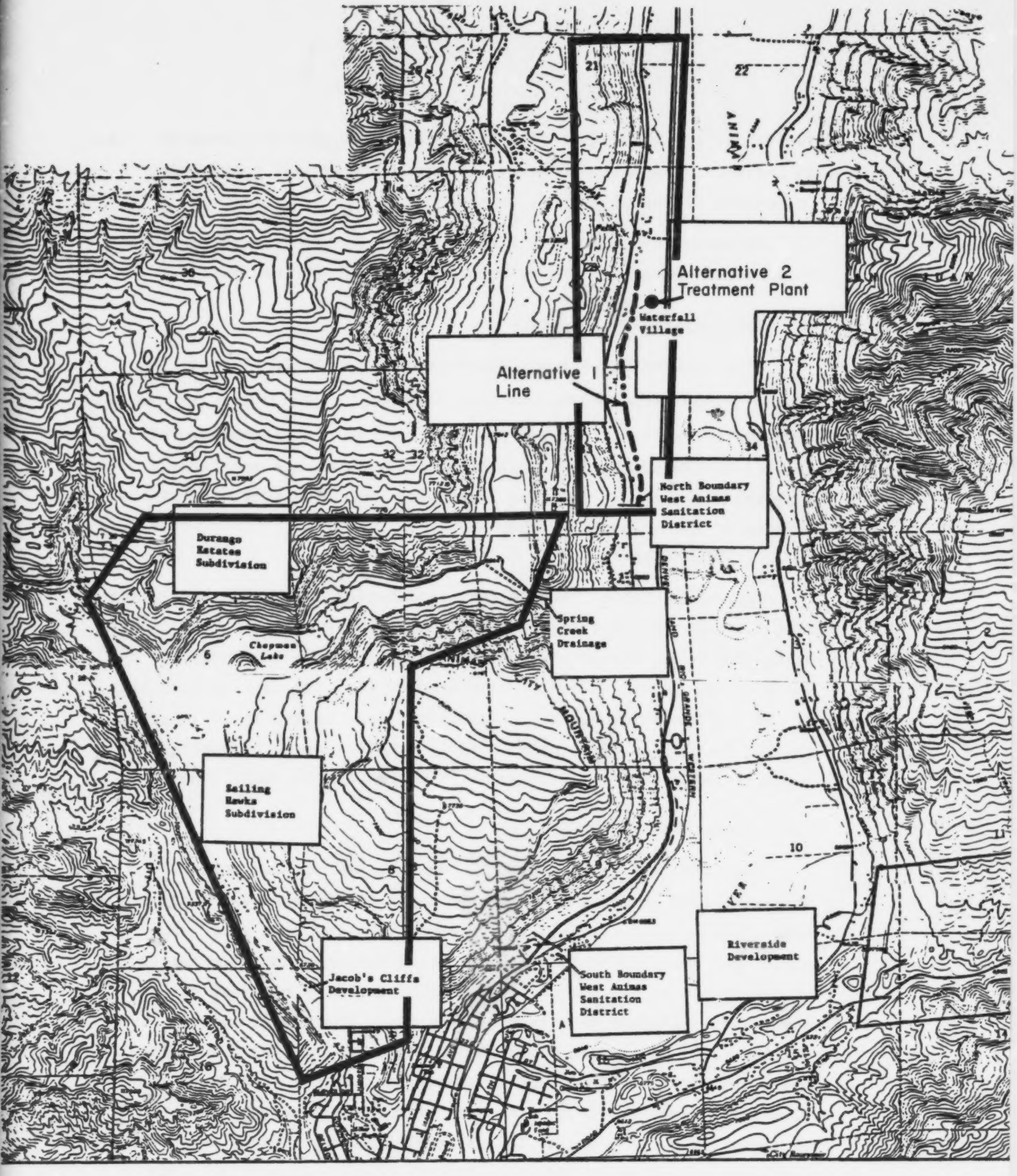

Alternative 2
Treatment Plant
Waterfall Village
Alternative 1
Line
North Boundary
West Animas
Sanitation
District
Durango
Estates
Subdivision
Spring
Creek
Drainage
Chapman Lake
Sailing
Hawks
Subdivision
Jacob's Cliffs
Development
South Boundary
West Animas
Sanitation
District
Riverside
Development
21
22
30
31
32
32
34
6
8
10

Figure 3.13. Proposed Sewer Line for Alternative 1, and Alternative 2 Treatment Plant Location in the West Animas Area.

jurisdiction. The latter facility would be managed on a seasonal basis. In addition, the District could aid in monitoring and maintaining individual treatment systems in the area.

Equipment and operational needs of the District would be similar to those discussed for the Maintenance District for Hermosa.

Alternative 4 - No Action

This alternative was not addressed in the 201 Facilities Plan. However, residents in the area have expressed a preference for the EPA No Action alternative and it has been selected as the recommended plan for this area. Residents feel that present operation and maintenance problems occurring at existing facilities should be corrected at the expense of the individual owner.

PROJECT IMPLEMENTATION

Implementation of the projects recommended in the 201 Facilities Plan for each of the respective Study Areas must adhere to the Federal, State, and local regulatory framework as well as be responsive to the needs of the local residents. Factors pertinent to implementing all of the wastewater management alternatives were presented at length in the 201 Facilities Plan (Allen, 1980). The following discussion is based in large part on information presented in the Facilities Plan.

LOCAL REGULATORY FRAMEWORK

The City of Durango presently requires an "implied consent" agreement from certain extenders and users of their sewage facilities. Essentially, this is an agreement that the user will construct improvements to City Specification and that the user agrees to annexation by the City at such time as the City may wish to annex them. Through this type of agreement, the City does all billing (at an increased rate) and maintenance on sewer mains, manholes and lift stations. The agreement becomes the instrument for performing these services. The City of Durango, through this agreement, has the power to assess penalties, discontinue service, and place encumbrances upon the property receiving service. This is probably a good method of implementation of the Junction Creek

Plan, but holds little promise for the other plans because of large distances separating the other Study Areas from the City.

Existing Sanitation Districts (Lightner and West Animas) have established by-laws and rules and regulations identifying the method by which new users are added. This usually includes a petition process, public hearing, and signing of an agreement. For the Lightner Creek Plan, the various property owners would become involved in this petition process. The L.C.S.D. will require that all improvements be paid for by the petitioners. Thus a mechanism whereby the City of Durango, as EPA grantee would enable the petitioners to receive the 75 percent matching fund would have to be negotiated. The newly formed West Animas Sanitation District could accept petitioners from the West Animas Area by a similar mechanism. It is normal for the City of Durango to have the right of refusal to petitioners wishing to use District facilities that empty into the Durango Sewage Treatment Plant. The City is normally approached first in the petition process.

The formation of a sanitation district under Colorado Statute (C.R.S. 73-30-20-401-422) is a possibility for the Hermosa, Loma Linda, and Grandview areas. To do this, a citizens committee is formed and develops a service plan, including boundaries of the proposed district, system description, and estimated costs. The La Plata County Commissioners then hold public hearings on that plan and designate the Sanitation District. The District Court judge then holds a court hearing to designate an election date and certify the legality of the District. An election is held for a board of directors and for the existence of the district. The board of directors proceeds with the search for funding, development of plans, and specifications and construction. The process through an election takes about five months. An earlier effort to form a Hermosa Sanitation District failed in an election for formation (June 10, 1980). However, it is likely that the formation of this district will be reconsidered in light of this proposed Facility Plan.

The development of a coordinated Management Agency Agreement is of paramount importance in this plan if the proposals contained in the Facility Plan are to be implemented using grant funds. The roles and responsibilities of the various public agencies that might take part in such an agreement are discussed at length in the San Juan Region 208 Plan (CDLA and SJRC, 1979, pp. 47-62). Recommendations of this report include La Plata County areas in the City of Durango sewer system - Lightner Creek, Junction Creek, and West Animas Valley. The Grandview alternatives recommend utilization of a yet unbuilt City of Durango sewage treatment plant at a new site, the location of which the City of Durango may well change through further study. The Loma Linda and Hermosa alternatives are wholly within La Plata County, and not directly affected by City of Durango expansion plans; however, the Hermosa plant in particular is of interest to the City of Durango due to its discharge location, 11 miles above the Animas Raw Water intake. Thus, the need exists for close liason between the Durango City Council and the La Plata County Commissioners at the implementation stages of the 201 Facilities Plan.

USER COSTS

An expensive project, as defined in the Facilites Plan, is one in which user charges exceed $387.50 per year per household or $32.30 per month. Expensive alternatives were eliminated during the course of the 201 Study through the public participation process. User costs for the recommended alternatives presented in the Facilities Plan are as follows:

Alternative	Capital Cost	Monthly User Cost
Hermosa 1	$ 678,106	$ 8.48/month
Hermosa 2	850,562	8.85/month
Hermosa 3	1,037,619	8.14/month
Junction Creek	58,187	6.84/month
Lightner Creek	73,500	25.50/month
Grandview/Wilson Gulch 1	596,000	11.49/month
Grandview/Wilson Gulch 2	793,000	11.90/month
Grandview/Wilson Gulch 3	819,000	10.68/month
Loma Linda	348,000	11.21/month

RECREATIONAL USE

Section 301 (g) (6) of the Clean Water Act requires the collateral examination of recreational opportunities in the implementation of a 201 Facilities Plan. Liason with the Heritage Conservation and Recreation Service and Park organizations and, in particular, the Land and Water Conservation Fund, may yield fruitful expansions of recreational opportunities in La Plata County.

The Land and Resource Management Plan (LMP) of La Plata County utilizes a Parks and Open Space Plan. The capital improvements of this Facilities Plan should be utilized where possible to implement those recreational opportunities.

Specific recommendations for recreation in the Facilities Plan are:

(1) Utilize sewer line easements in Loma Linda, Grandview, and Hermosa for Bicycle Commuter paths. Both areas are within reasonable commuting distance by bicycle of Durango, and such paths would provide incentives to residents,

(2) Utilize the Hermosa lagoon site as a picnic park area and to provide fishermen access to the Animas River, and

(3) Investigate the possibility of a ball-field at the Loma Linda sewage treatment plant site.

Staging of Construction

Under EPA guidelines, a staging period of 10 years would be required for sewage treatment plants built within this Plan. For treatment facilities, a small aerated lagoon achieves high marginal savings with increase in size. Excavation, area of liners required, and land area all decrease per unit volume in a geometric manner with arithmetic increase in daily flow. This means it costs less to build and operate a system with excess capacity now that it would to build a new addition to the system later. Certain equipment needs have a linear increase with flow, such as oxygen diffusers and blower capacity. Chlorination equipment and other possible injection processes would be sized for ultimate design.

Thus, the staging recommended is minimal. Aerated lagoons would be built and lined to ultimate sizes initially. Diffusion equipment below water level would be sized at ultimate flow due to the difficulty of adding such hardware at a future date. Blower sizing and capacity would be submitted to a cost-effectiveness examination. It may be possible that blower sizings are also most economical at ultimate requirements, with lower cycling times at first.

For interceptors, Colorado State Regulations require minimum 8-inch diameter pipe for public sewers at a low slope of 0.004 (0.4 percent). Using pipe with a Manning n=0.009 and 75 gallons per capita per day, and a 3 to 1 peak to average flow, a population equvalent of 3160 persons can be accommodated at minimum slope. This amount increases with the square root of the slope. In none of the areas is such a combination of population and pipe size encountered at the 20-year estimate. Hermosa is designed with a 10-inch central interceptor and is sufficient for the 2,800 plus total persons expected at the year 2000 and large amounts of unforeseen growth. In all other areas, utilizing minimum sewer sizings also allows for an immediate 20-year capacity staging effect.

Implementation Schedule

The construction timetable for the Facilities Plan depends to a great extent upon (1) the initiative of the private citizens in the respective Study Areas, (2) the development of a Management Agency Agreement, and (3) securing funding from EPA through the Colorado Department of Health. Once La Plata County has accepted its designation as managing agency for wastewater management in the areas identified in the 208 plan and the necessary agreements with Durango and any other implementing agency have been made, a significant reduction in time could be realized through a combined Step II and Step III grant - Engineering and Construction in one application, provided for under EPA regulations for communities under 25,000 population. This is a category that the City of Drango, as grantee, would meet.

CHAPTER 4

DESCRIPTION OF THE AFFECTED ENVIRONMENT

CHAPTER 4

DESCRIPTION OF THE AFFECTED ENVIRONMENT*

The Study Area is located in southwestern Colorado in the Animas River drainage. The area is bordered by the San Juan Mountains to the north and west, and by plateaus and mesas to the south and east. The region is a popular recreational area for skiers, bikers, campers, and sightseers. Durango is the major population center in the Study Area with trade and tourism its predominant businesses.

TOPOGRAPHY

Elevations in the Study Area range from about 6,400 feet to 8,800 feet above mean sea level. The area is situated in a transitional area of the Southern Rocky Mountain Physiographic Province and the Colorado Plateau Province. The Southern Rocky Mountain Province, represented by the San Juan Mountains, is characterized by high peaks, great relief, and ruggedness. Rocks are of igneous, metamorphic, and sedimentary origin, and soils are generally shallow. It is a scenic area of mixed bare rock and forest, with valuable water and mineral resources. The Colorado Plateau Province, Navajo Section, represented by plateaus and mesas, consists of extensive areas of nearly horizontal sedimentary formations, structural upwarps, igneous structures, steep walled canyons, and a shortage of water. It is an area of bare rock, sparse vegetation, and highly varied desert scenery.

Principal features of the Study Area include Animas City Mountain northwest of Durango, Florida Mesa southeast of Durango, and the Animas and Florida River valleys.

*Supplemental data on the environment of the Study Area is presented in Appendix A.

GEOLOGY

The geologic character of the Study Area is quite diverse and complex. Within the Study Area there are nineteen geologic formations and eleven surficial deposits. Geologic features can be separated into two general groups along an east-west line north of the City of Durango. Formations north of this line form the basal structure of the southern edge of the San Juan Mountains; south of this line the geology has formed mesas and plateaus. Geologic formations north of the separation line range in age from Upper Cretaceous to Precambrian (63 to 600 million years old), while formations south range in age from Quaternary to Upper Cretaceous (1 to 63 million years old). Quaternary alluvium is common in most stream beds.

When considering wastewater management in the Study Area, geologic features must be considered in those areas currently and/or potentially facing development. These areas are generally restricted to the drainage valleys. They consist primarily of water-borne deposits that are composed of alluvium, terrace gravels, and alluvial fan deposits, and of glacial till deposits. Alluvium is comprised of silt, sand, and gravel which is associated with modern flood plains. Terrace gravels are old stream deposits lying on surfaces above the present flood plain. Alluvial fan deposits are sand, gravel, and wash deposits set down in a fan-shaped wedge at the mouths of tributaries. Glacial till deposits are poorly sorted silt-to gravel-sized material deposited by glacial ice. In the Animas River Valley north of Durango the majority of the existing development has occurred on the alluvial deposits. Alluvial deposits are also found in the bottomlands of Junction Creek, Lightner Creek and the Florida River. Northeast of Durango, in the Animas Valley, glacial till deposits can be found.

The remaining geologic formations in the southern portion of Study Area have formed the Florida Mesa and the lower segments of the Florida and Animas Rivers. The Florida Mesa consists of the Animas Formation; the remaining areas are alluvial deposits from the Animas and Flordia Rivers. The Animas Formation is a dark vari-colored sandstone, shale, and conglomerate which contains abundant volcanic and ankosic detritus.

Surficial deposits associated with the Animas Formation include alluvial-colluvial deposits and some alluvial deposits. The alluvial formations of the Mesa have surficial deposits of pediment gravels with some colluvial deposits (gravity transported hillside detrital) on the western edges. Along the edges of the Florida and Animas River alluvium, and in intermittent drainages off of the Mesa, the San Jose, Nacimiento and Animas Formations occur.

GEOLOGIC HAZARDS

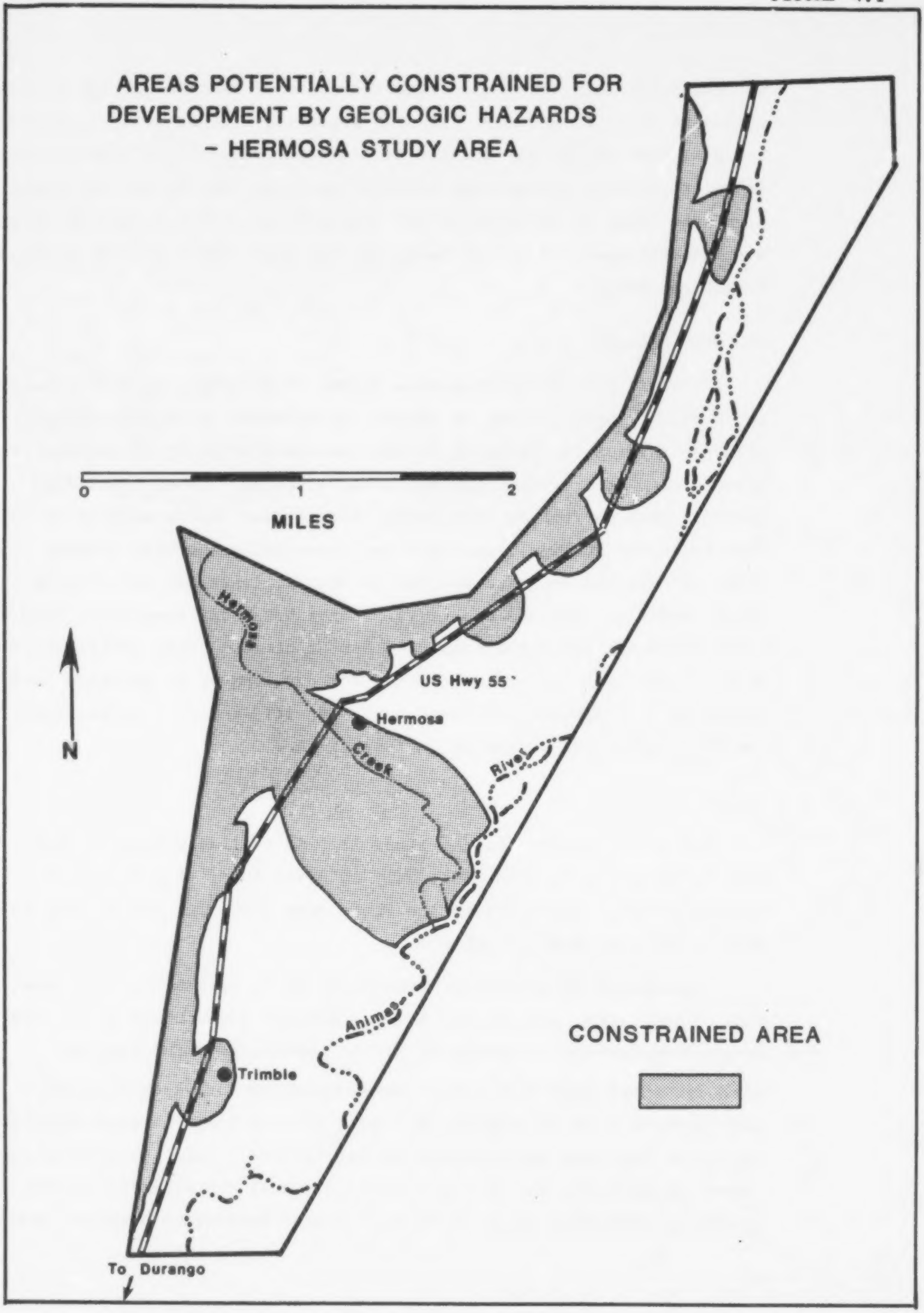
Geologic hazards are numerous in the Study Area. La Plata County is in Seismic Zone Two and is subject to moderate earthquake damage. Although several faults exist in the immediate vicinity of Durango, no known faults occur within the six areas of study. Other identified geologic hazards include rock falls, debris fans (areas subject to wash from tributary streams), unstable and potentially unstable slopes, areas of high and moderate erosion potential, landslide and mudflow areas, and slope failure complexes. These hazardous conditions have been responsible for preventing the development of some sites within the Study Area. Areas potentially constrained for development by geologic hazards are shown in Figures 4.1 through 4.6. Specific geologic constraints for these areas are presented in Appendix A.

SOILS

Soils information for the Study Area is available from the U.S. Soil Conservation Service (SCS) only in draft form. A preliminary listing of soils map units in the Study Area and their limitations to development are shown in Table 4.1.

High ground water levels, occurrence of floods, excessive slope, slow permeability, and shallow bedrock are all constraints that could preclude successful operation of septic tank-leach field systems. Although actual soil conditions and suitability for waste disposal systems have to be determined on a site by site basis through soil tests,the following generalizations can be made. Soil types rated as "Poor" in Table 4.1 for one or more of the soil characteristics are generally considered unsatisfactory for such wastewater disposal systems.

FIGURE 4.1



AREAS POTENTIALLY CONSTRAINED FOR DEVELOPMENT BY GEOLOGIC HAZARDS - HERMOSA STUDY AREA

0
1
2
MILES
N
Hermosa
US Hwy 55
Hermosa
Creek
River
Animas
Trimble
To Durango
CONSTRAINED AREA
▨

AREAS POTENTIALLY CONSTRAINED FOR DEVELOPMENT BY GEOLOGIC HAZARDS - JUNCTION CREEK STUDY AREA

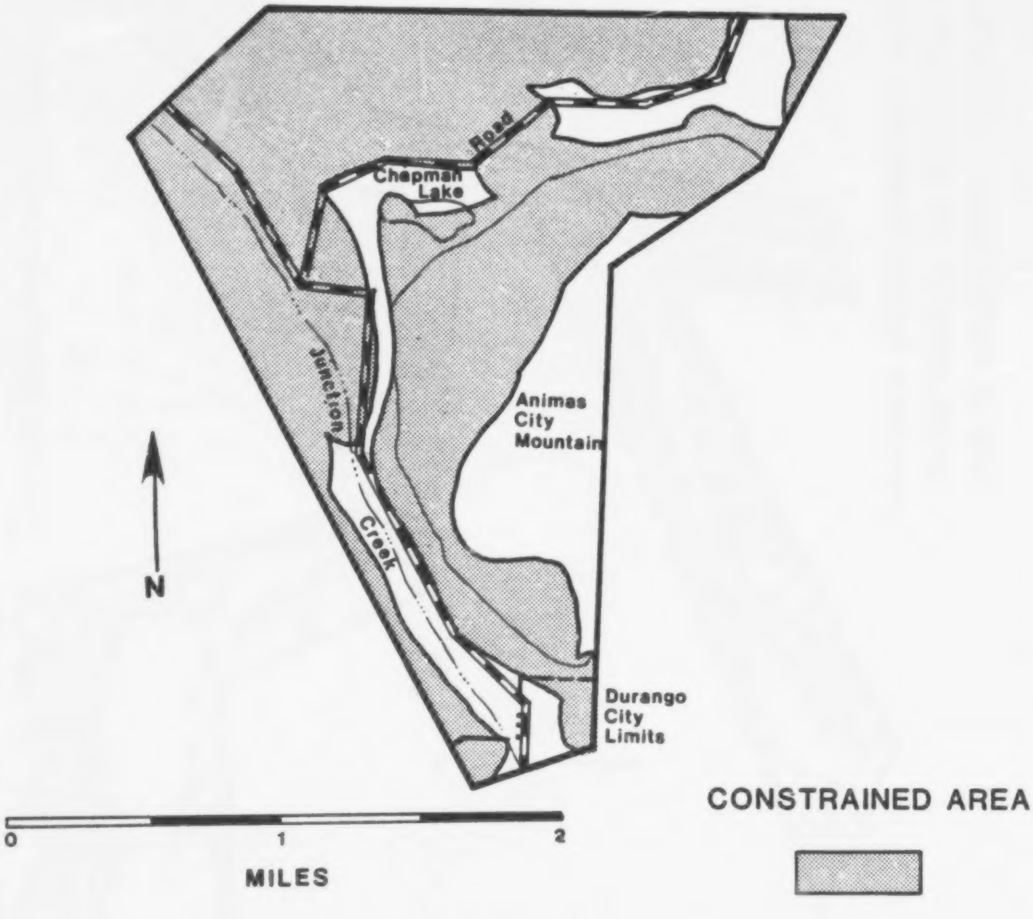
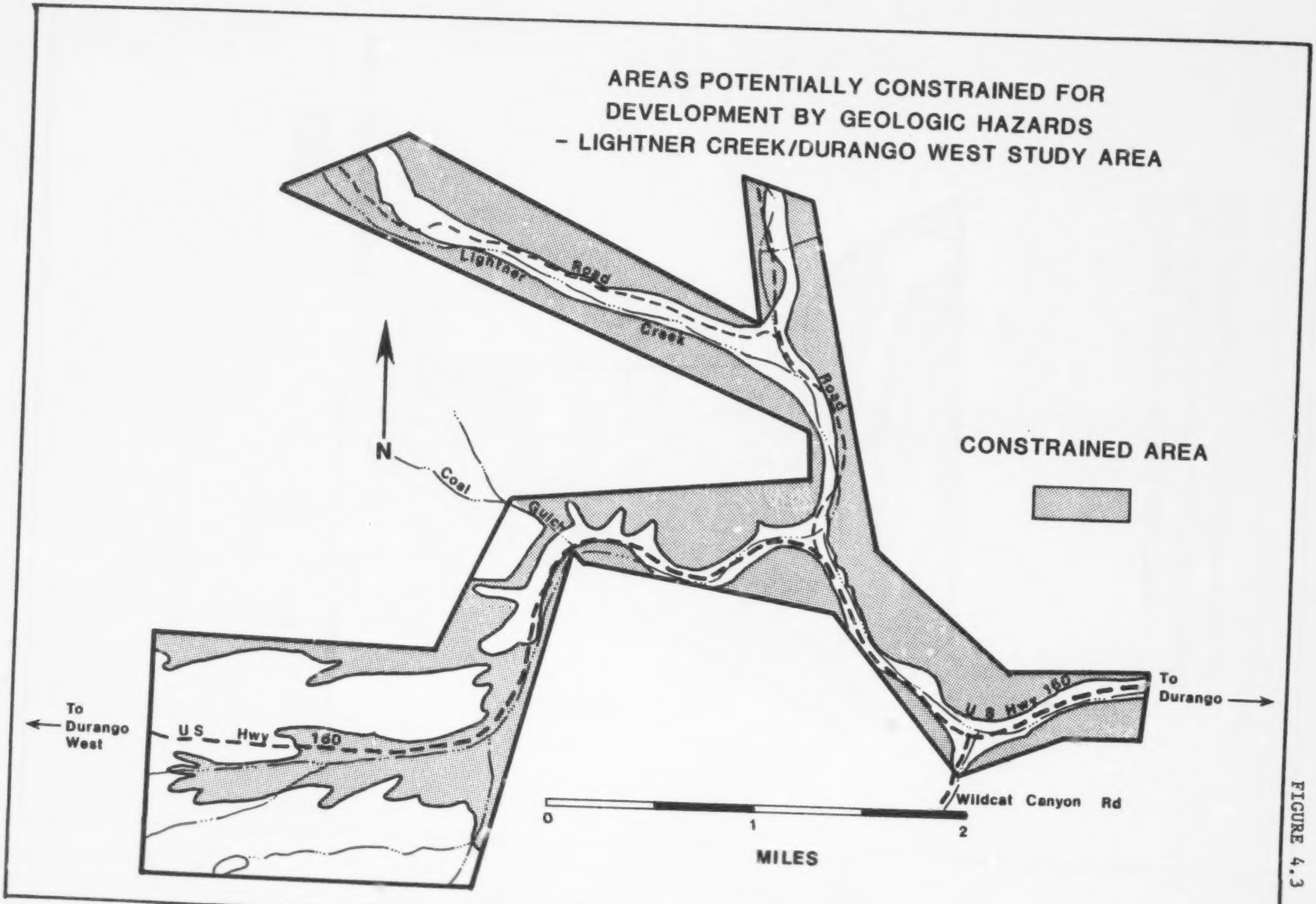

Road
Chapman Lake
Junction
Creek
Animas City Mountain
N
Durango City Limits
0
1
2
MILES
CONSTRAINED AREA
▨

FIGURE 4.3



AREAS POTENTIALLY CONSTRAINED FOR DEVELOPMENT BY GEOLOGIC HAZARDS - LIGHTNER CREEK/DURANGO WEST STUDY AREA

CONSTRAINED AREA
▨
N
Lightner
Road
Creek
Road
Coal
Gulch
To Durango West
U S Hwy 160
U S Hwy 160
To Durango
Wildcat Canyon Rd
0
1
2
MILES

FIGURE 4.4

AREAS POTENTIALLY CONSTRAINED FOR
DEVELOPMENT BY GEOLOGIC HAZARDS
- GRANDVIEW/LOMA LINDA STUDY AREA

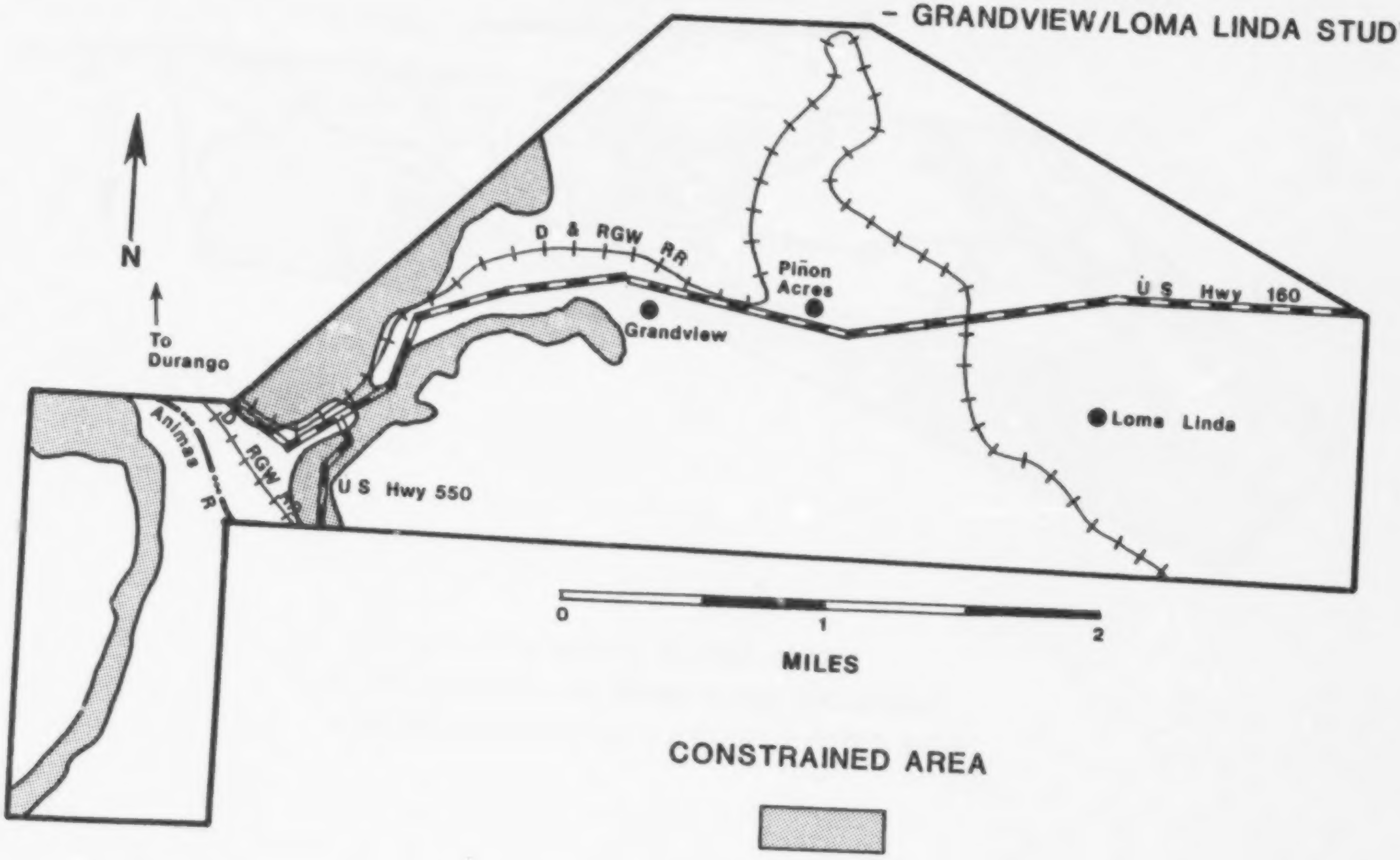

N
To Durango
D & RGW RR
Piñon Acres
U S Hwy 160
Grandview
Loma Linda
Animas R
D RGW RR
U S Hwy 550
0
1
2
MILES
CONSTRAINED AREA

FIGURE 4.5

AREAS POTENTIALLY CONSTRAINED FOR
DEVELOPMENT BY GEOLOGIC HAZARDS
- FLORIDA ROAD STUDY AREA

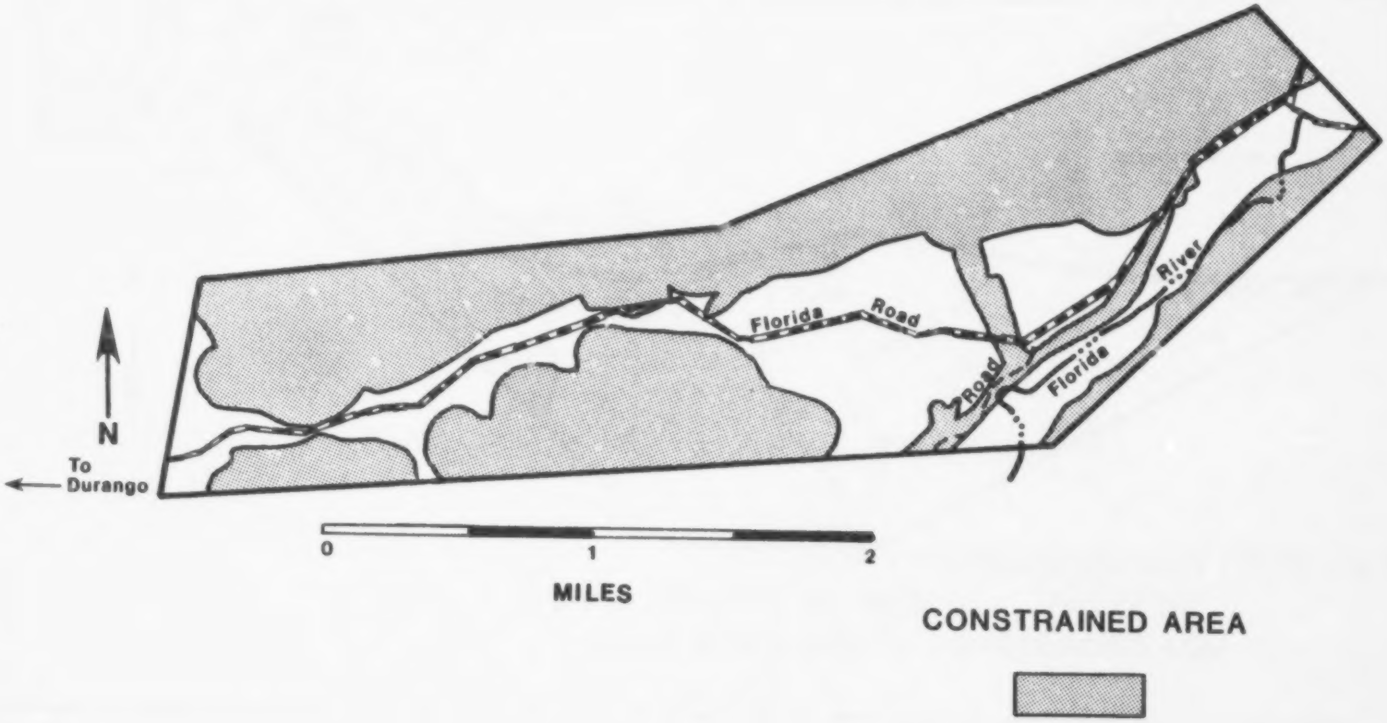

N
To Durango
Florida Road
Road
Florida River
0
1
2
MILES
CONSTRAINED AREA

FIGURE 4.6

AREAS POTENTIALLY CONSTRAINED FOR DEVELOPMENT BY GEOLOGIC HAZARDS - WEST ANIMAS STUDY AREA

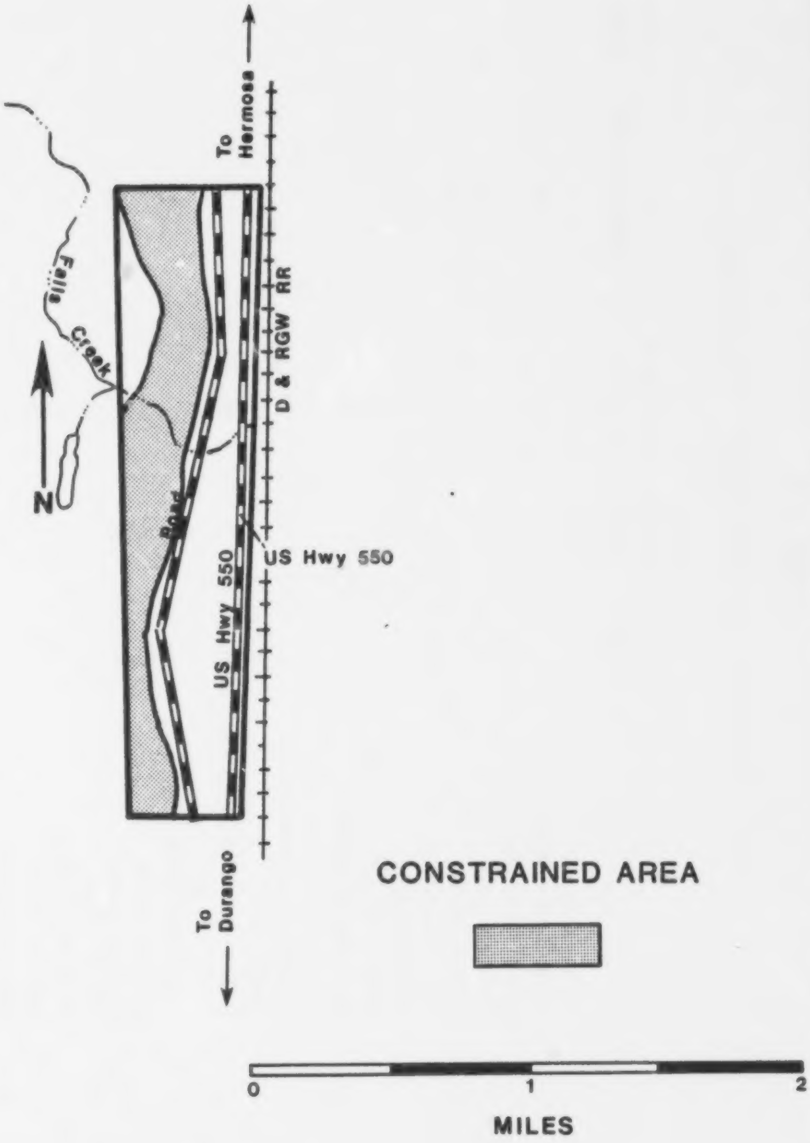

To Hermosa
Falls Creek
D & RGW RR
N
Road
US Hwy 550
US Hwy 550
To Durango
CONSTRAINED AREA
0
1
2
MILES

TABLE 4.1

SOIL LIMITATIONS AND DEVELOPMENT CAPABILITIES

	SOIL	FLOODS OCCUR	HIGH WATER TABLE	EXCESSIVE SLOPE	SLOW PERMEABILITY	SHALLOW BEDROCK	EXCESSIVE SHRINK-SWELL
Animas River Valley (Includes Hermosa & West Animas Areas)	Werlow Loam	P	P				
	Connerton Loam			F	M		
	Humbarger Loam		P				
	Pescar Loam	P	P		M		
	Garza Loam			P	M		
	Fluvaquent	P	P				
	Riverwash	P	P				
	Haploborolls Rubble			P			
	Fortwingate-Rock			P		P	
	Garza-Clayburn Rock						
	Goldvale-Fortwingate			P		P	P
	Valto Rock			P			
	Uinta-Leadville-Anvik			P			
Florida River Valley (Includes Florida Road Area)	Hesperus Loam				P		
	Werlow Loam	P	P				
	Pescar Loam	P	P		M		
	Plome Loam			F			F
	Goldvale Loam			P	F		M
	Nordic Loam			P			
	Alamosa Loam		P				
	Clayburn Loam			F	F		
	Fluvaquent	P	P				
	Carracas-Sanchez Outcrop			P	M	P	
	Valto Rock			P			
	Fortwingate-Rock			P		P	
Florida Mesa (Includes Grandview, Loma Linda, Air Park Area)	Falfa Loam				F		F
	Heldt Loam				F		F
	Werlow Loam	P	P				
	Midway Loam			P		P	P
	Big Blue Loam	P	P				
	Gaynor Clay				P	P	P
	Midway Rock			P	P	P	P

TABLE 4.1 (Continued)

SOIL LIMITATIONS AND DEVELOPMENT CAPABILITIES

	SOIL	FLOODS OCCUR	HIGH WATER TABLE	EXCESSIVE SLOPE	SLOW PERMEABILITY	SHALLOW BEDROCK	EXCESSIVE SHRINK-SWELL
Lightner Creek	Pescar Loam	P	P		M		
	Fortwingate Loam			F		P	
	Anvik Loam			P			
	Nehar Loam						F
	Cold Creek Loam			P		P	
	Hesperus Loam				P		
	Midway Loam			P		P	P
	Goldvale Loam			P	F		M
	Carracas-Sanchez Outcrop			P	M	P	
	Fortwingate-Rock			P		P	
	Haploborolls-Rubble			P			
Junction Creek	Pescar Loam	P	P		M		
	Midway Loam			P		P	P
	Fortwingate Loam			F		P	
	Hesperus Loam				P		
	Connerton Loam			F	M		
	Big Blue Loam	P	P				
	Carracas-Sanchez Outcrop			P	M	P	
	Fortwingate-Rock			P		P	
	Haploborolls Rubble			P			
	Valto Rock			P			

Legend for Development Capability:

Poor (P):	The soil type requires intensive and costly engineering design measures to overcome physical limitations. For some types of facilities adequate engineering modifications may not be realistically feasible.
Fair (F):	The soil type requires some special engineering design considerations to accommodate facility installation. Most soil limitations can be resolved through appropriate design techniques.
Moderate (M):	The soil type requires compensating engineering designs to minimize soil limitations. Most constraints are readily resolved with standard techniques.

Using these criteria, only six soils map units are considered as unconstrained for septic tank-leach field systems: Connerton Loam, Plome Loam, Clayburn Loam, Falfa Loam, Heldt Loam, and Nehar Loam.

Soils in the West Animas and Hermosa units are primarily loam and river wash flanked by rubble and rock outcrops. The loamy soils on both sides of U.S. Highway 550 in the eastern half of the West Animas sub-area are probably satisfactory for septic tank-leach fields.

The Junction Creek valley consists of loam bordered by soil-rock outcrops and badlands. The entire Junction Creek area is generally constrained for septic tank-leach fields except for small areas of Connerton Loam east of Chapman Lake.

The Lightner Creek-Durango West area consists of loamy soils flanked by soil-rock outcrops. A large area of Plome Loam, potentially suitable for septic tank-leach fields, occurs in the southwestern corner of the area on both sides of U.S. Highway 160; otherwise only a few scattered areas have soils suitable for wastewater land disposal systems.

Loam, clay, and clayey-loam soils make up most of the Grandview, Loma Linda, Air Park area. According to SCS characteristics, extensive areas of Falfa Loam and Heldt Loam make most of this unit suitable for septic tank-leach field systems. In practice, however, soil permeabilities in this area are often too slow to make land disposal of wastewater practical.

Soils in the Florida Road area consist of loam and fluvaquents in the flood plain areas and rock outcrops at the flood plain perimeter. Most of the area of this unit is judged to be constrained for septic tank-leach field systems.

Five soil types located within the Study Area have been designated by the SCS as prime agricultural soils when irrigated. These include Connerton loam (slope 1-3 percent), Humbarger loam (slope 3-6 percent), Falfa loam (slope 1-3 percent), Heldt silty clay loam (slope 0-3 percent), and Satanta loam (slope 1-3 percent). These soil types are located in relatively small fragmented areas in the Animas Valley near Hermosa and the West Animas areas and on the Florida Mesa near Grandview and Loma Linda.

WATER RESOURCES

Surface Water Hydrology

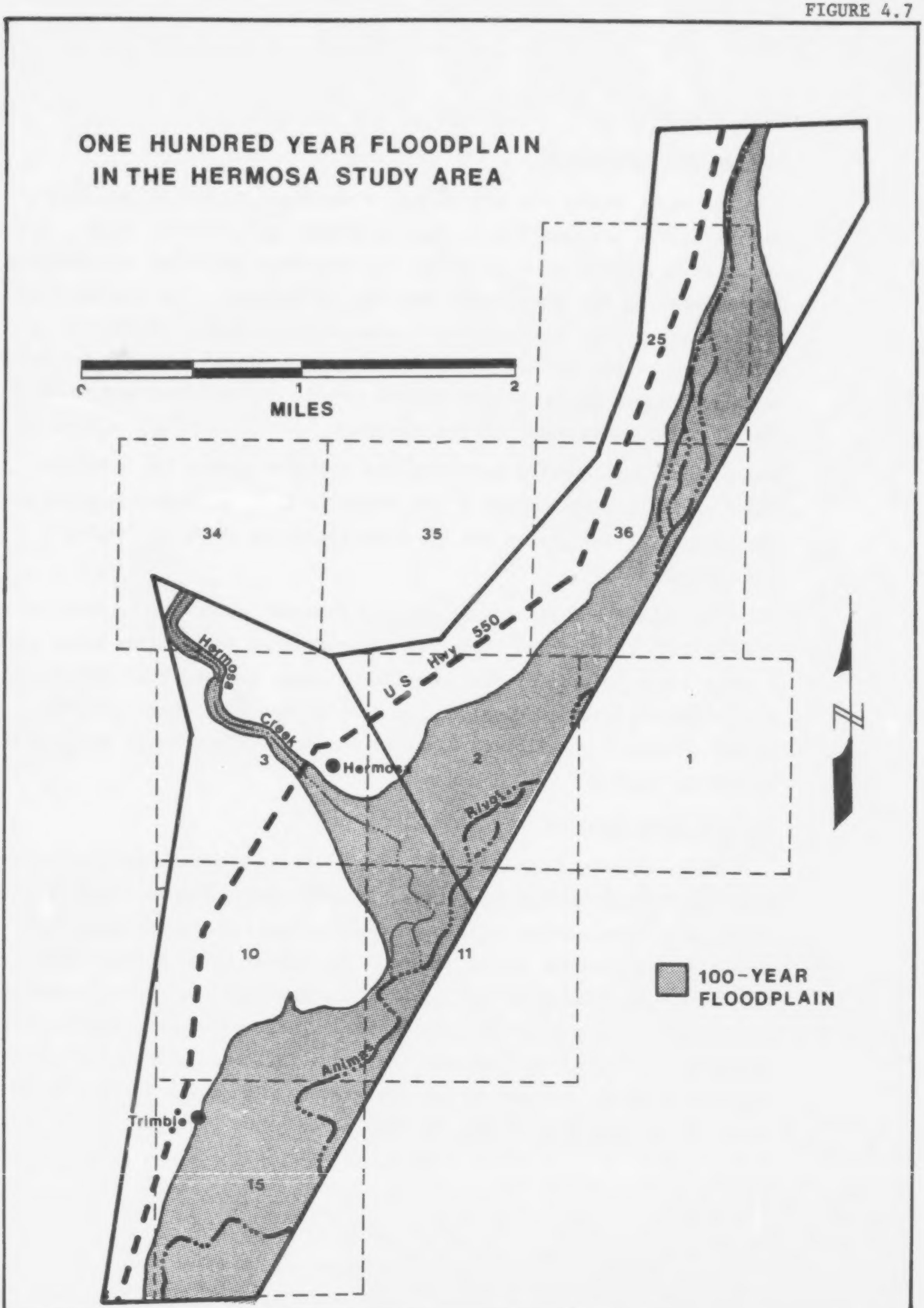
The major surface waters in the Study Area are the Animas River, Florida River, Lightner Creek, Hermosa Creek, and Junction Creek. The Animas River is the major drainage with Hermosa, Junction, and Lightner Creeks entering the river north and west of Durango. The Florida River is tributary to the Animas River southeast of Durango. Streamflow is southward into New Mexico. These drainages originate in steep, rugged, heavily forested areas. Heavy thundershowers in the river and creek drainages can cause severe local flooding. Portions of all of the areas except the Florida Road area are included within the 100-year flood plains for the Animas River, Lightner Creek or Junction Creek. The 100-year flood plains for the five areas are shown in Figures 4.7 through 4.11.

The Animas and Florida Rivers are domestic water supply sources for the City of Durango. Water is diverted from the Florida River at a point one mile west of the junction of Lemon Dam and Vallecito Reservoir Road. Water is diverted from the Animas River near the 32nd Street Bridge.* The Florida River is currently the primary water supply source for Durango.

Surface Water Quality

Water quality in the Animas River drainage has been affected by many man-related activities. These include mining runoff, urbanization, water diversions, irrigation return flows, and wastewater treatment plant discharges (Allen, 1980). The Animas River above Baker's Bridge has degraded water quality for pH, hardness, sulfates, turbidity, conductivity and total dissolved solids. These parameters indicate that nonpoint sources and mining activities are influencing the quality of the Animas River upstream of the Study Area. The water quality of the Animas River improves within the Study Area above Durango.

FIGURE 4.7



ONE HUNDRED YEAR FLOODPLAIN IN THE HERMOSA STUDY AREA

0
1
2
MILES
25
34
35
36
US Hwy 550
Hermosa Creek
3
Hermosa
2
1
River
10
11
Animas
Trimble
15
N
100-YEAR FLOODPLAIN

ONE HUNDRED YEAR FLOODPLAIN IN THE JUNCTION CREEK STUDY AREA

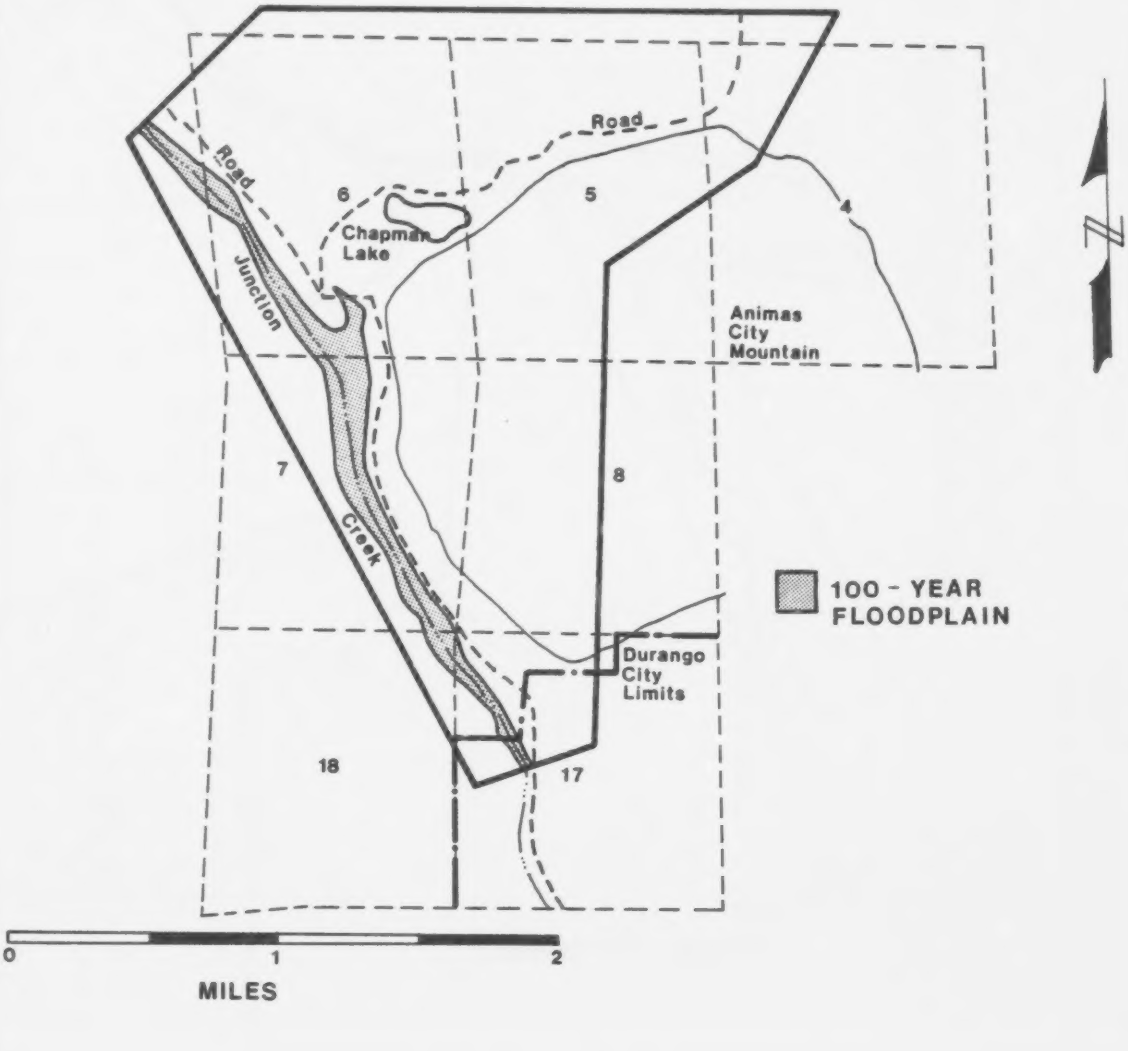
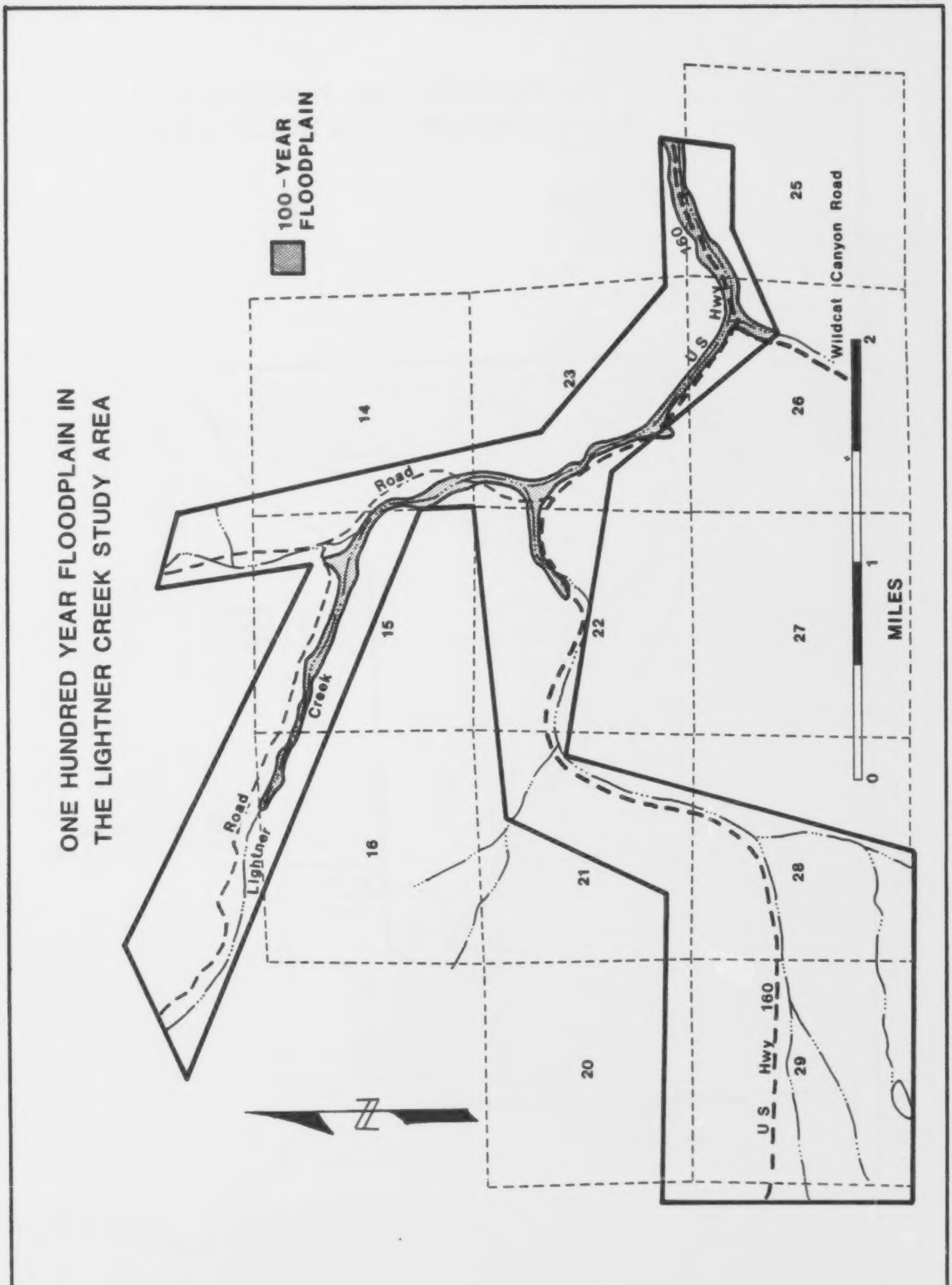

Road
Road
6
5
4
Chapman Lake
Junction Creek
Animas City Mountain
7
8
100 - YEAR FLOODPLAIN
Durango City Limits
18
17
0
1
2
MILES
N

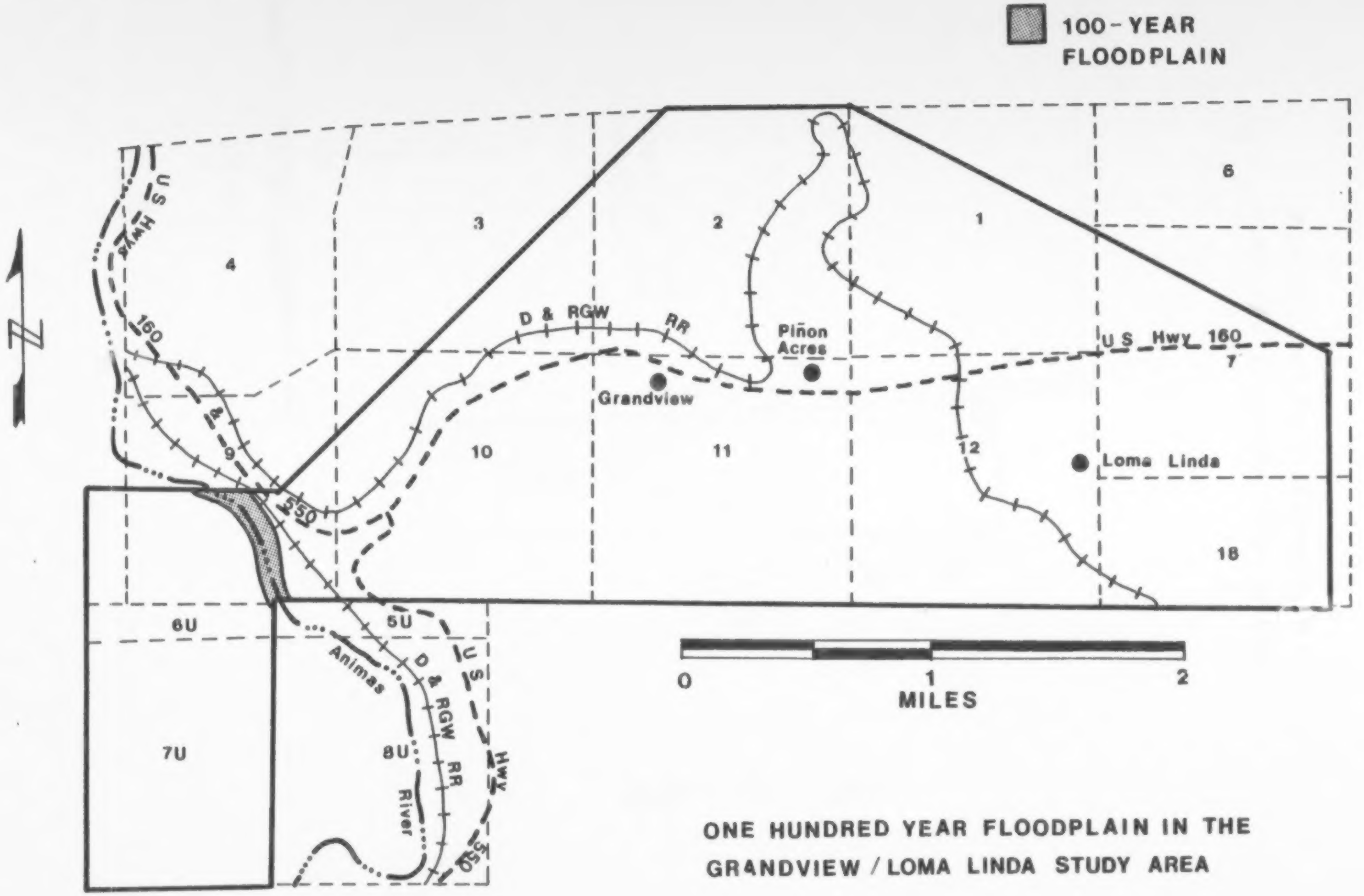
FIGURE 4.9



ONE HUNDRED YEAR FLOODPLAIN IN THE LIGHTNER CREEK STUDY AREA

100-YEAR FLOODPLAIN
14
15
16
20
21
22
23
25
26
27
28
29
Lightner
Creek
Road
Road
US Hwy 160
US Hwy 160
Wildcat Canyon Road
N
0
1
2
MILES

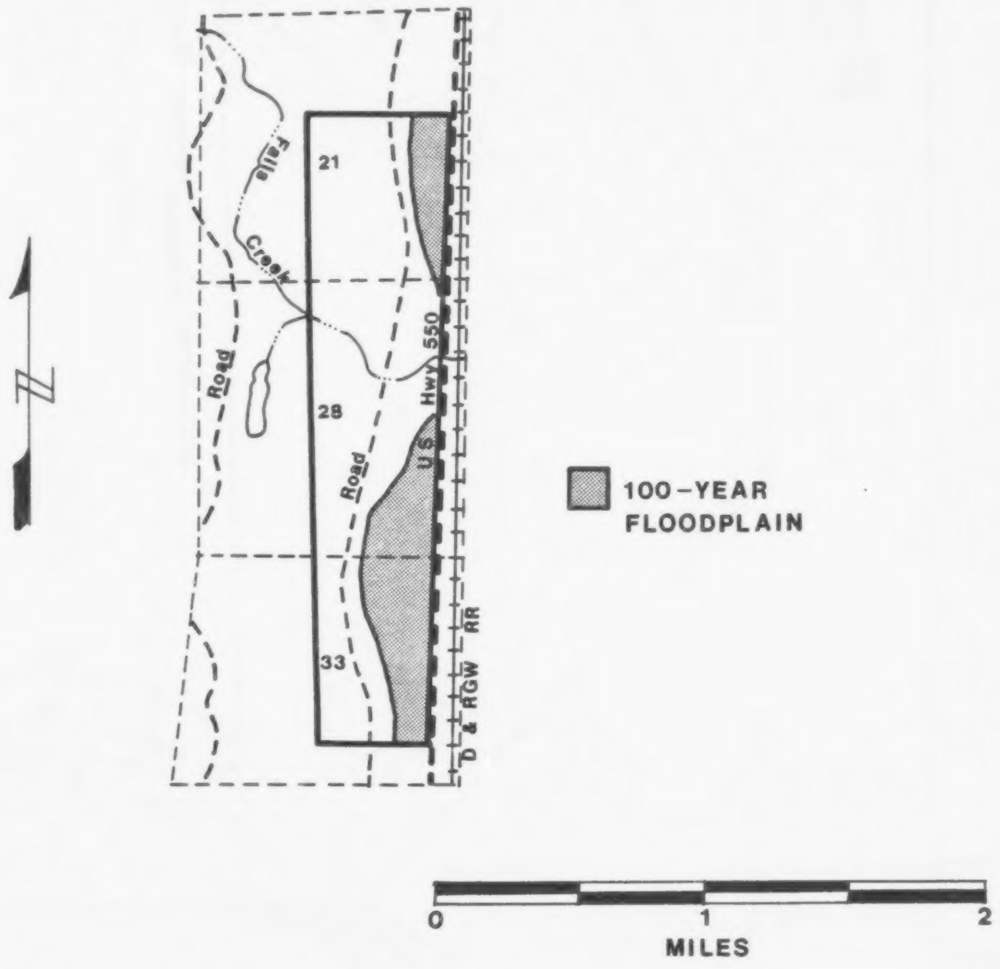
FIGURE 4.10


100-YEAR FLOODPLAIN
N
U S Hwys
160
4
3
2
1
6
D & RGW
RR
Piñon Acres
U S Hwy 160
7
Grandview
9
350
10
11
12
Loma Linda
18
6U
5U
7U
8U
Animas
River
D & RGW RR
U S Hwy 550
0
1
2
MILES

ONE HUNDRED YEAR FLOODPLAIN IN THE GRANDVIEW / LOMA LINDA STUDY AREA

FIGURE 4.11

ONE HUNDRED YEAR FLOODPLAIN
IN THE WEST ANIMAS STUDY AREA


N
Falls
Creek
21
28
33
Road
Road
U.S. Hwy 550
D & RGW RR
▨ 100-YEAR FLOODPLAIN
0
1
2
MILES

Water quality degradation occurs in the Animas River as it passes through Durango and out of the Study Area. The river experiences significant increases in hardness, specific conductivity, nutrient levels (specifically a doubling in mean nitrate concentrations), total dissolved solids, sodium, chloride ions, and fecal coliform bacteria. Changes in these parameters are indicative of the introduction of wastewater discharges. Increases in concentrations of total coliforms and selected heavy metals also occur in this area.

Water quality parameters of concern in the Florida River include alkalinity, hardness, total dissolved solids, and conductivity, with measureable amounts of ammonia. Water quality of the Florida River is influenced primarily by reservoir releases, agricultural activities, and nonpoint sources. The Florida River apparently has very little effect on the water quality of the Animas River below the confluence. Comparison of water qualities from both rivers above and below the confluence indicated that there is no significant effect from the Florida River.

Analysis of the existing data base indicates that Lightner Creek is a primary source of degraded water for the Animas River. Concentrations of pollutants generally increase downstream in Lightner Creek to its confluence with the Animas River. It is probable that Lightner Creek has an adverse impact on the Animas River's water quality for the following parameters: temperature, total and fecal coliform concentrations, hardness, conductivity, turbidity, sulfates, and nutrients. A study in 1974 indicated that the degraded quality of Lightner Creek could probably be linked to nine wastewater dischargers located on the creek (CDH, 1974). These dischargers have subsequently been eliminated.

Water quality sampling on the other tributaries (Junction Creek, Hermosa Creek, and the Florida River) has been very restricted and therefore provides very little analytical information for assessing water quality problems.

Ground Water Hydrology

In the central portion of La Plata County, ground water supplies are available from sandstone, siltstone, shale, and unconsolidated deposits such as clay, silt, sand, gravel, and boulders. Two basic types of aquifers are present in the Study Area. Alluvial aquifers are found in the present stream valleys, and bedrock aquifers are associated with nearby slopes and upland sites.

The alluvial aquifers are thickest, as much as 30 feet, in the Animas River Valley north of Durango. The deposits are absent or less than 10 feet thick south of Durango. Alluvial aquifers in the Florida River Valley are generally less than 20 feet thick. Yields from wells completed in the alluvial aquifers average 15 gallons per minute because of low permeability and limited saturated thickness (Brogden and Giles, 1976). Alluvial aquifers are recharged by infiltration of precipitation, stream flow, and seepage from irrigation ditches. Ground water discharges from these aquifers, in turn, contribute to base flow in the streams.

Ground water movement in bedrock aquifers is generally southward towards the San Juan River in New Mexico. Bedrock aquifer recharge is accomplished by the infiltration of precipitation and by the movement of ground water from nearby alluvial aquifers along a hydraulic gradient. The water-yielding capabilities of bedrock aquifers varies according to fracture porosity and permeability. Most reported well yields in the Durango area range from less than 1 gallon per minute (hard shales and limestone) to 10 gallons per minute (fractured shales and sandstone) (Brogden and Giles, 1976).

Ground Water Quality

Analytical ground water quality data are sparse and incomplete for the Study Area. Detailed data are available for 27 wells, primarily in two areas, Florida Mesa and the Florida River Area east of Durango. Each well was sampled once. No data are available for the Animas Valley near Hermosa or for the area along the Animas River south of Durango.

Ground water was analyzed for the following parameters: sodium, heavy metals, chloride ions, nitrate-nitrite, and sporadically for fluoride ions. The quality of ground water is quite variable and ranges from poor to good. Ground water from most wells is highly mineralized and requires some treatment. Chloride concentrations were well below the domestic water supply standard in all wells tested except for one in the Florida River Study Area. No standard currently exists for sodium concentrations, but a former standard of 270 mg/l can be used as a guideline. Only two wells sampled exceed this value, and most have less than one-third that concentration. Concentrations of both iron and manganese which exceed the state standard were found in two widely spaced wells, and one well in the Florida Mesa had a selenium concentration 15 times greater than the state standard. Otherwise, dissolved heavy metals were not a serious ground water problem. Four wells in the Florida River and Florida Mesa areas showed nitrate plus nitrite concentrations at or above the nitrate standard. It is unknown if these were the result of natural or man-induced contamination.

No fecal coliform counts exceeding the state raw water standard were found in ground water samples. Total coliform counts of up to 500 per 100 milliliter were detected in springs sampled, but these springs were subject to surface contamination and did not accurately reflect ground water conditions.

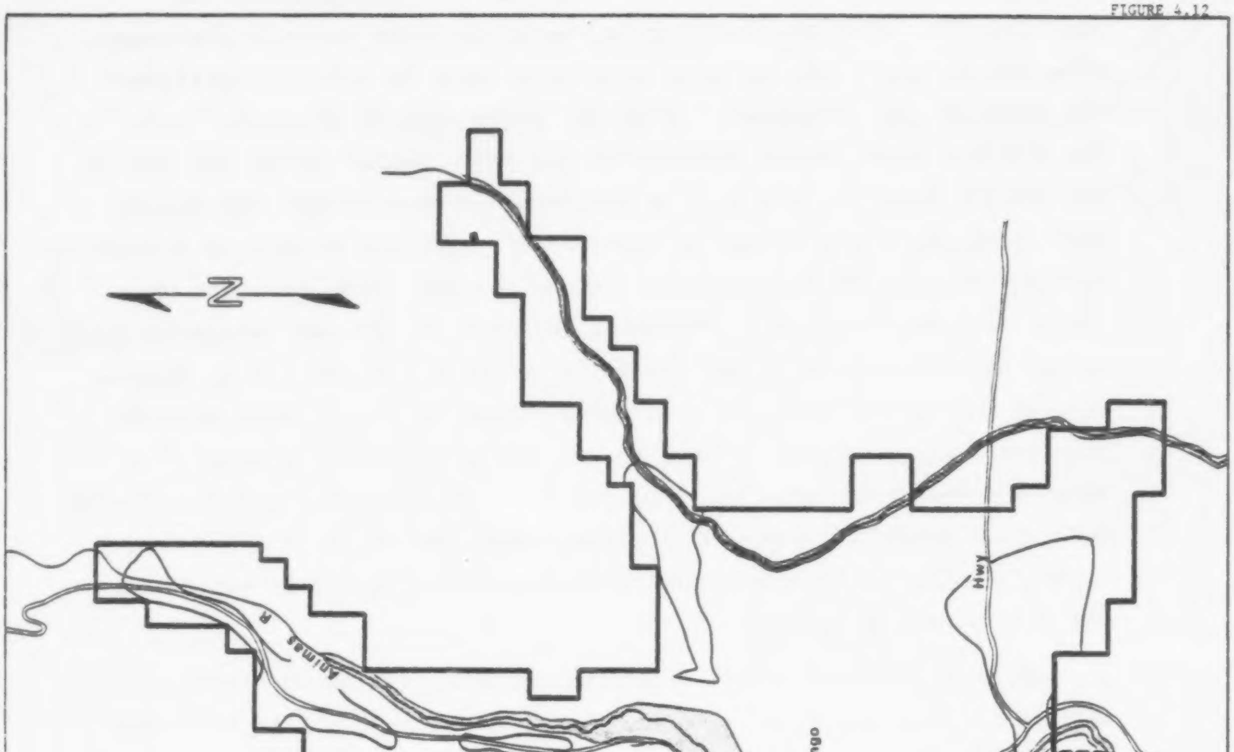
BIOLOGICAL RESOURCES

Vegetation

Vegetation in the Rocky Mountain region is influenced by elevation, exposure, temperature, soils, topography, and land use. Broad, general vegetation zones are separated using altitude variation. Within each zone smaller sub-units of vegetation can be identified and their components inventoried.

The Study Area ranges in elevation from about 6,400 feet in the Animas Valley south of Durango to about 8,800 feet. The principal vegetation communities of the Study Area include Ponderosa pine forest, pinyon-juniper woodland, mountain shrub, sagebrush, riparian woodland, and croplands. Wetland and riparian areas are shown on Figure 4.12.

FIGURE 4.12



LOCATIONS OF WETLANDS AND RIPARIAN AREAS

N
Animas R
Durango
Hwy
2
0
1
2
3
MILES

Vegetation inventories have been conducted in relation with the Animas - La Plata Project. These inventories cover the plant communities which are common to this Study Area. The large number of variations in physical site conditions have produced a large variety of habitats suitable for many different plant species. Vegetation studies in the Study Area have identified about 557 species present.

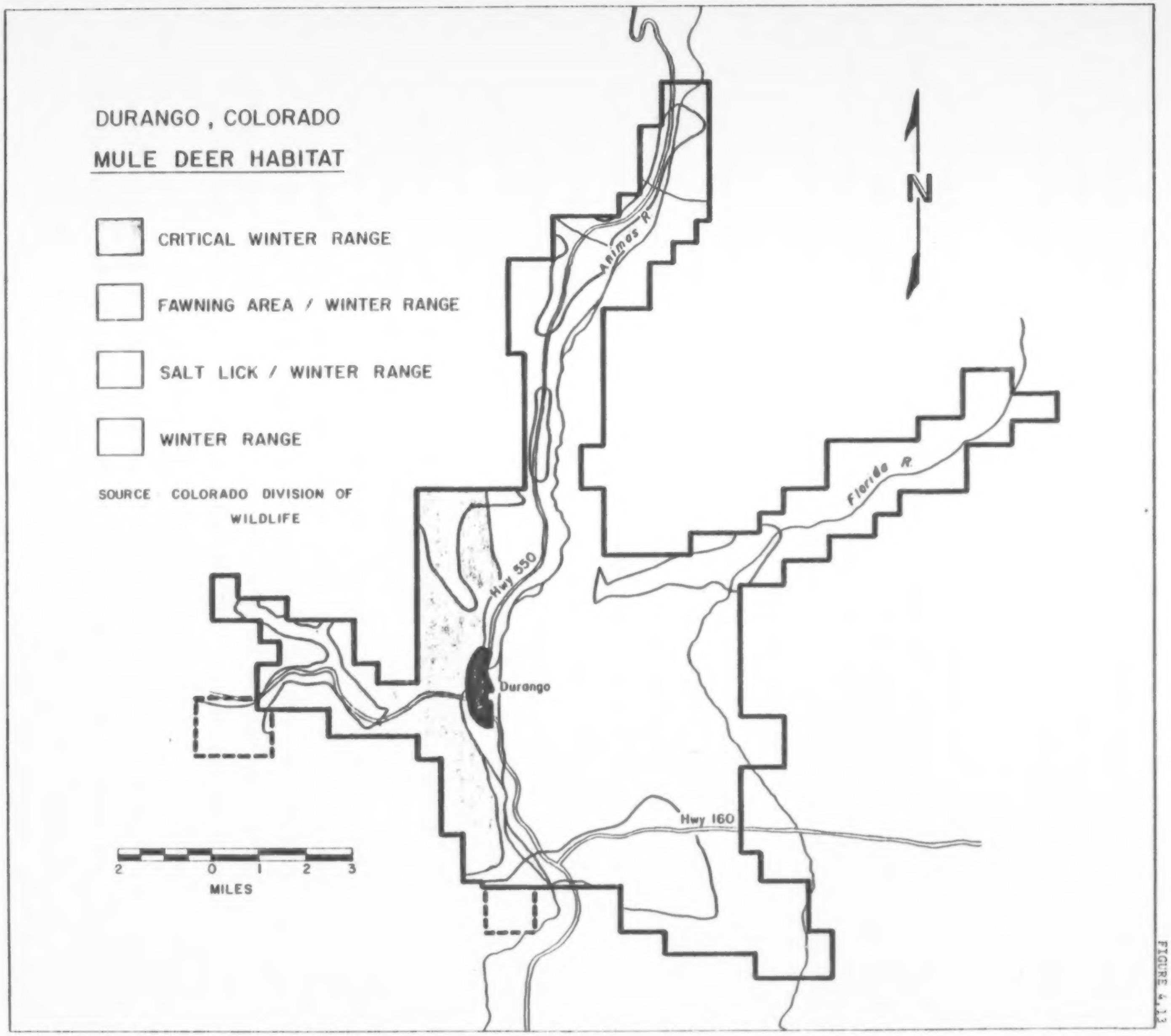
Wildlife

Wildlife investigations conducted by the Colorado Division of Wildlife and the Fort Lewis College Biology Department have identified 50 species of mammals and 64 species of birds in the Durango area. Forty-eight of these are considered game species by the Colorado Division of Wildlife. In addition, 22 species of reptiles and seven species of amphibians have been found in the area.

Big game species in the area include mule deer, elk, bighorn sheep, Rocky Mountain goat, black bear, and mountain lion. In general, the major big game habitat is located north of Highway 160. The area of highest concentration is the Animas River drainage north and west of Durango. This area is designated as having critical winter range, concentration areas, and fawning and calving areas. Important areas for mule deer, elk, and bighorn sheep are shown in Figures 4.13, 4.14, and 4.15 respectively. Upland game which occur in the San Juan basin include wild turkey, blue grouse, ptarmigan, and chukar partridge. The furbearer populations of the region consists of beaver, muskrat, and historically, mink. All three of these animals are water-oriented in their habitat requirements. In addition, red and grey fox, and pine marten are found in the area. Foxes occur in the rougher terrain adjacent to river bottoms and in agricultural areas. The two major predator species are the coyote and bobcat. Both occur throughout the region.

Four raptors of the area are the golden eagle, the bald eagle, the osprey, and the peregrine falcon. Both the golden eagle and the peregrine falcon nest on bluffs and ridges such as those in the Study

FIGURE 4.13



DURANGO, COLORADO

MULE DEER HABITAT

SOURCE COLORADO DIVISION OF WILDLIFE

CRITICAL WINTER RANGE
FAWNING AREA / WINTER RANGE
SALT LICK / WINTER RANGE
WINTER RANGE
N
Animas R.
Florida R.
Hwy 550
Hwy 160
Durango
2 0 1 2 3
MILES

FIGURE 4.14

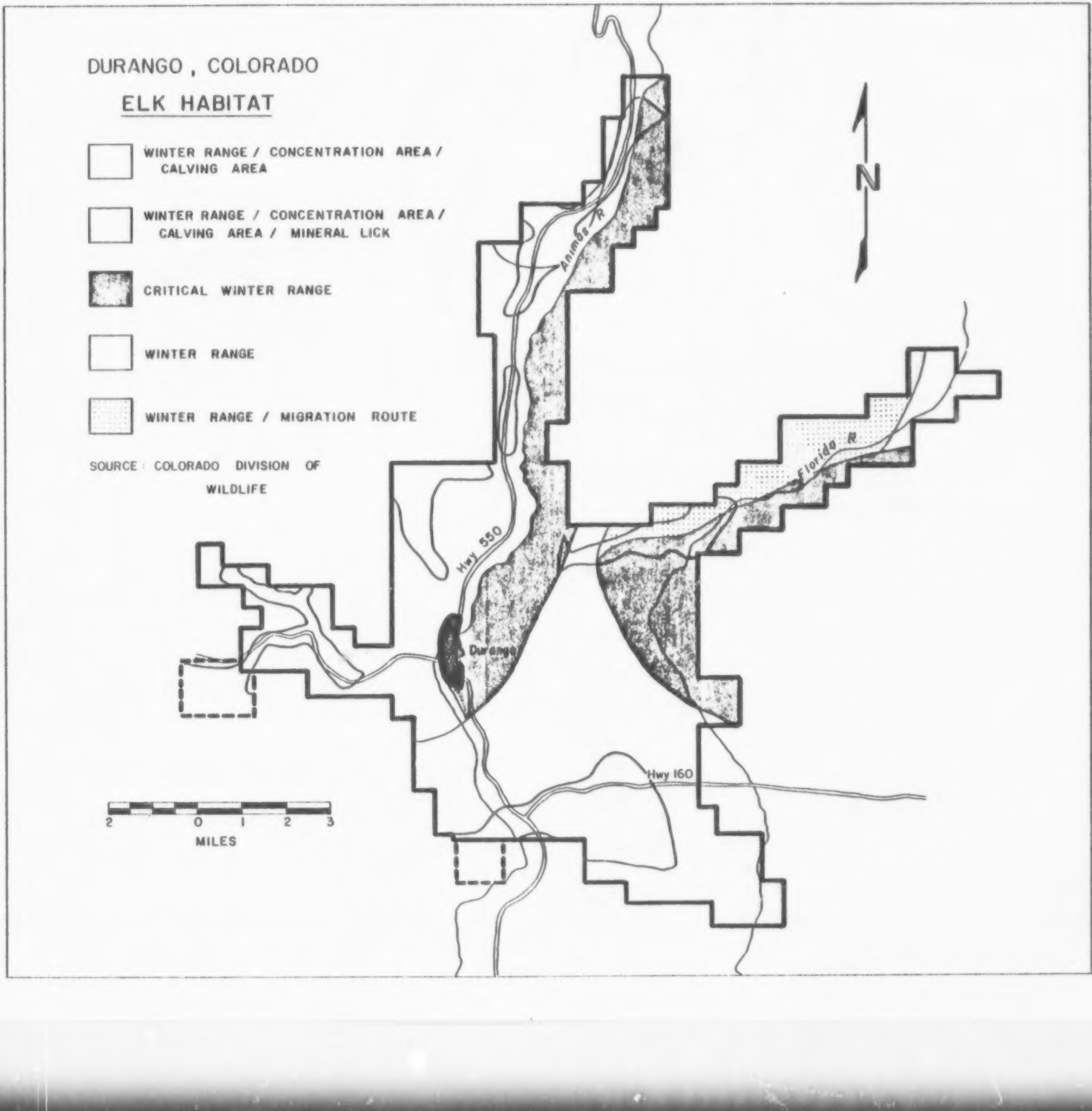
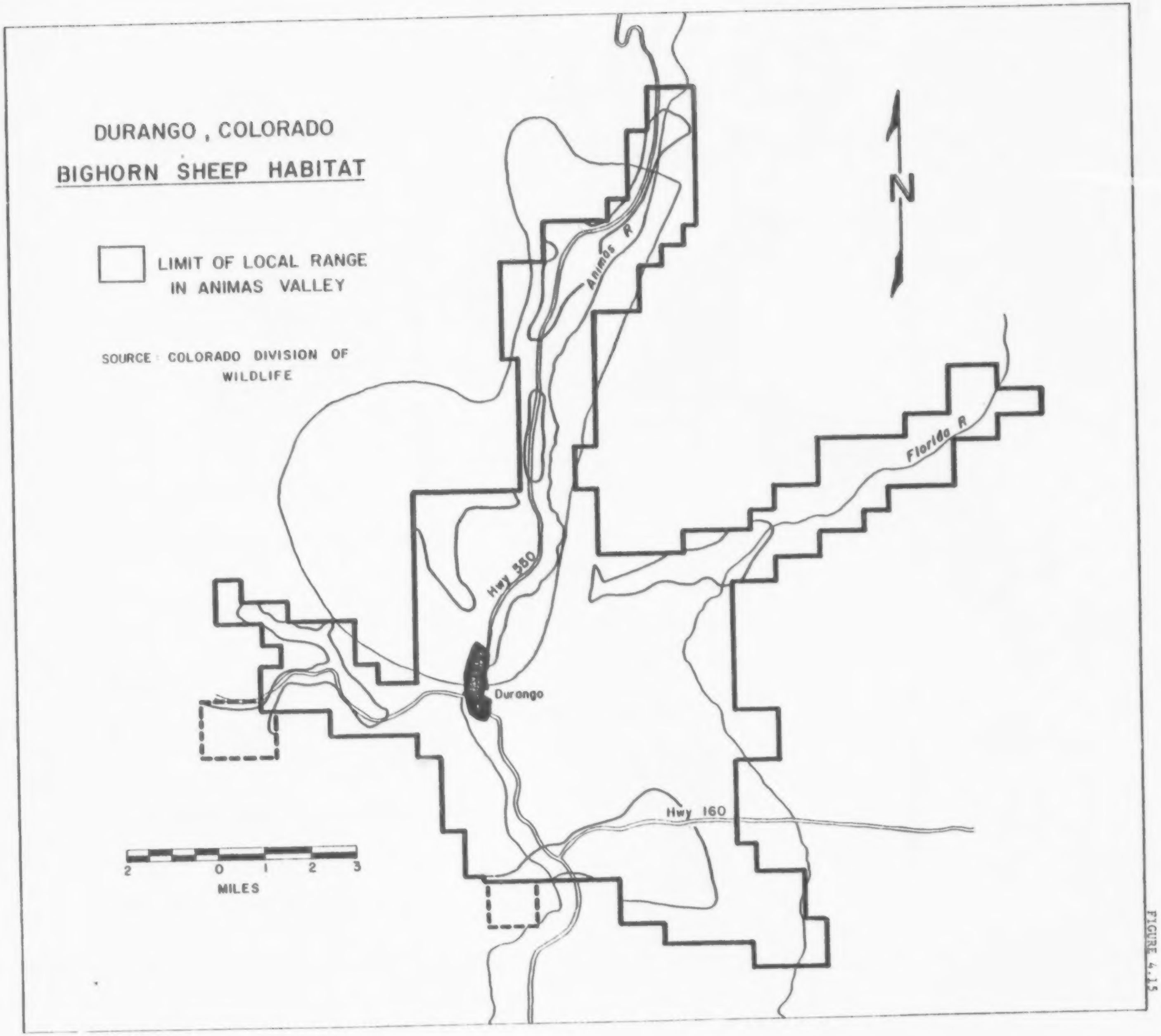

DURANGO, COLORADO
ELK HABITAT
WINTER RANGE / CONCENTRATION AREA / CALVING AREA
WINTER RANGE / CONCENTRATION AREA / CALVING AREA / MINERAL LICK
CRITICAL WINTER RANGE
WINTER RANGE
WINTER RANGE / MIGRATION ROUTE
SOURCE: COLORADO DIVISION OF WILDLIFE
N
Animas R
Florida R
Hwy 550
Durango
Hwy 160
2
0
1
2
3
MILES

FIGURE 4.15



DURANGO, COLORADO

BIGHORN SHEEP HABITAT

☐ LIMIT OF LOCAL RANGE IN ANIMAS VALLEY

SOURCE: COLORADO DIVISION OF WILDLIFE

N
Animas R
Florida R
Hwy 550
Durango
Hwy 160
2
0
1
2
3
MILES

Area. Ospreys are known to nest on reservoirs north of Durango. The bald eagle is a common winter resident usually found in the vicinity of streams and reservoirs. However, all of these birds are wide-ranging predators and could be sighted anywhere in the Study Area. Important nesting and/or hunting habitats for these species are shown in Figures 4.16 through 4.18.

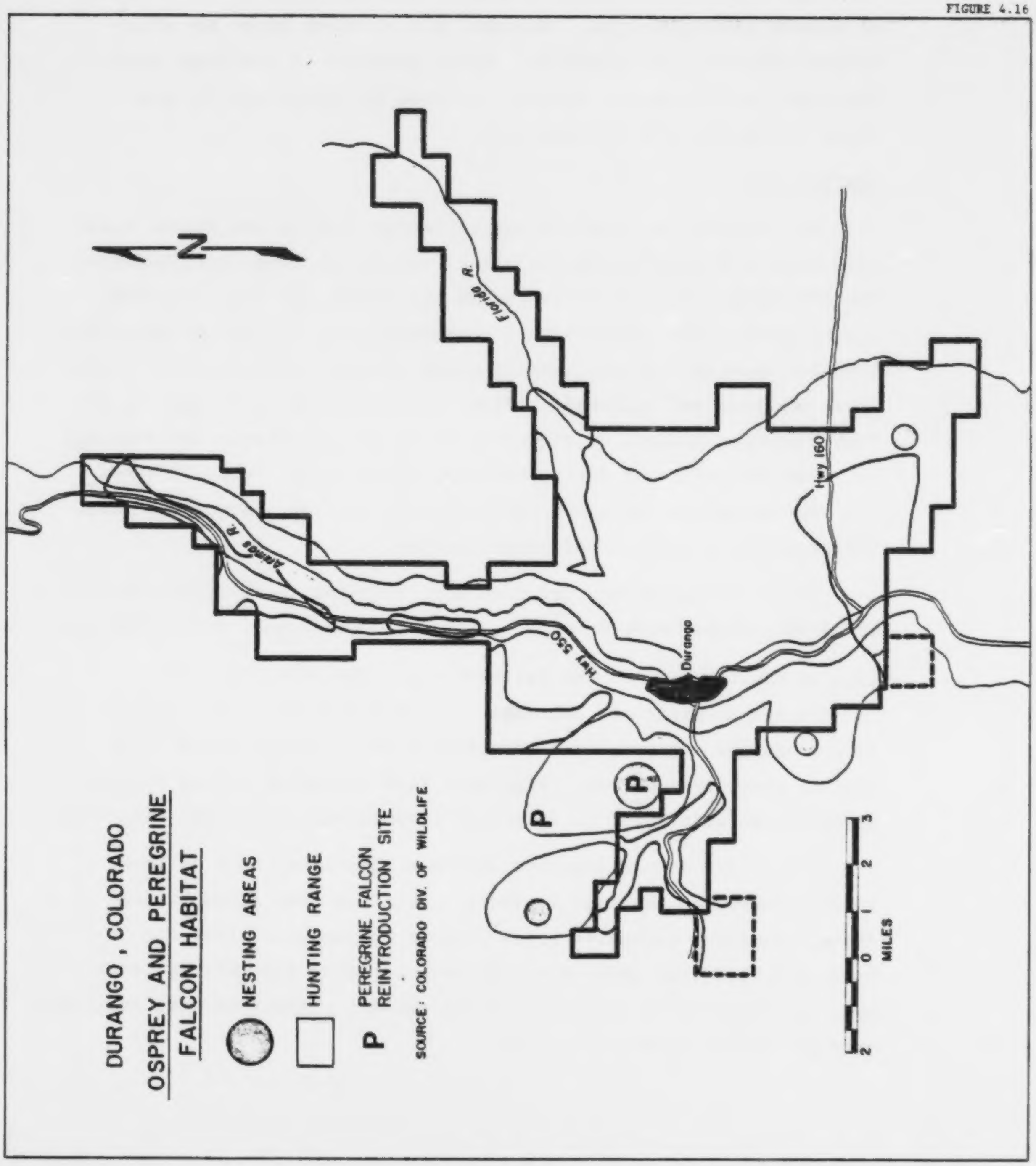
Aquatic Life

The Division of Wildlife has collected fish in the Animas River from Baker's Bridge to the Stateline, and in the river's tributaries. The following fish were collected in the Animas drainage: rainbow trout, brown trout, brook trout, cutthroat trout, flannelmouth sucker, bluehead mountain sucker, western white sucker, speckled dace, fresh-water sculpin, and bullhead catfish. Several additional species of fish have been planted or are known to be present within the drainage but were not collected during the sampling program. These include the Kokonee salmon, northern pike, channel catfish, largemouth bass, yellow perch, bluegill, and green sunfish.

In the Animas River, the fish population estimates above Durango are double those below Durango. This is a consequence of the difference in habitat between the two sections. The game fish estimates for the Animas River are extremely low with respect to the size of the river, and the non-game fish populations are slightly higher than what is considered normal. High game fish estimates in the Florida River can be attributed to increased productivity below the reservoir.

The entire Animas drainage has been maintained as a rainbow trout fishery for the past 20 years. This has been accomplished through numerous catchable trout planted in the main river and various tributaries each year. Harvest patterns for various trout species removed from the Animas River and its tributaries are available through the Division of Wildlife.

FIGURE 4.16



DURANGO, COLORADO

OSPREY AND PEREGRINE FALCON HABITAT

NESTING AREAS
HUNTING RANGE
P PEREGRINE FALCON REINTRODUCTION SITE
N
Florida R.
Animas R.
Hwy 550
Hwy 160
Durango
P
P
2
0
1
2
3
MILES

SOURCE: COLORADO DIV. OF WILDLIFE

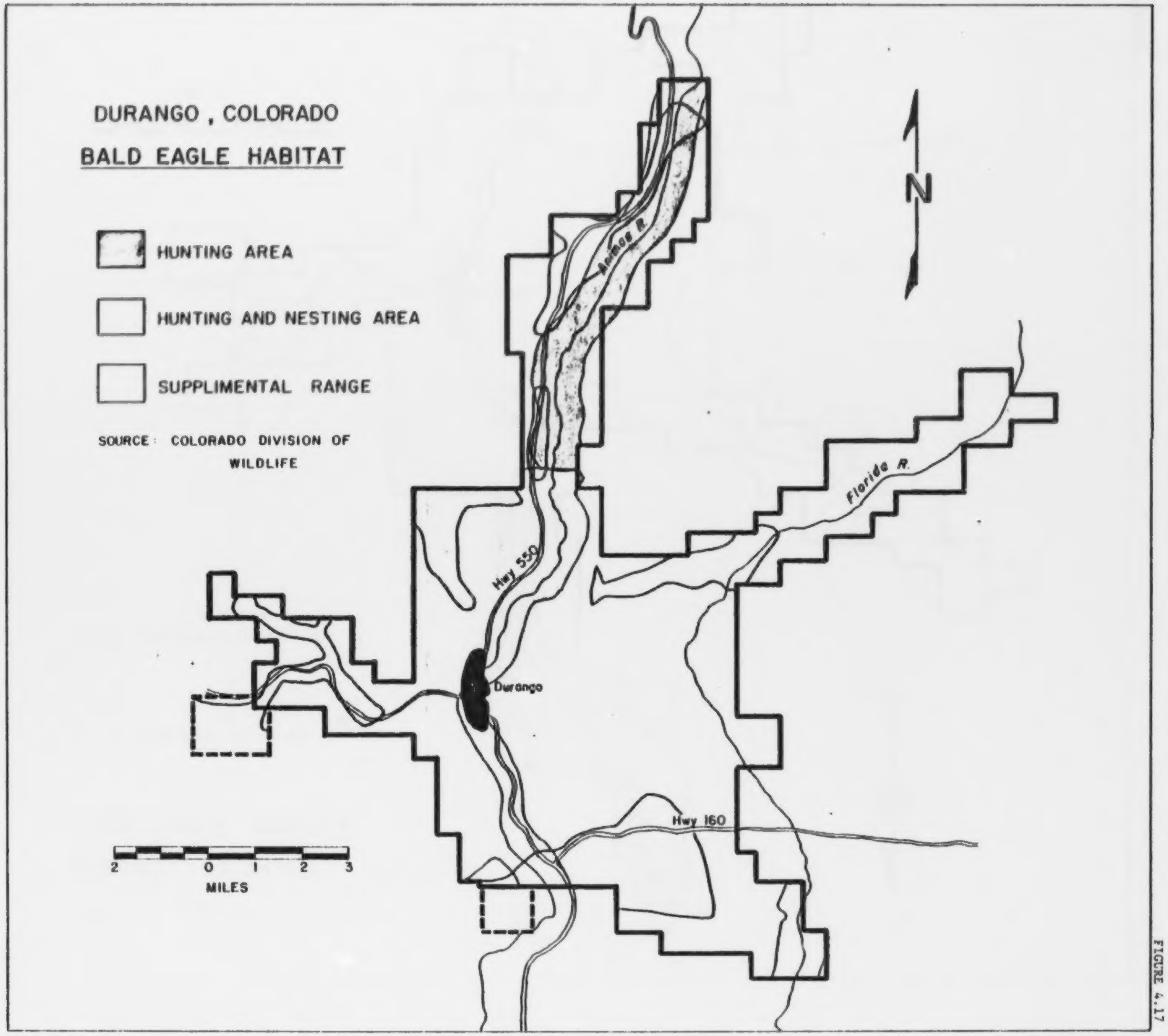
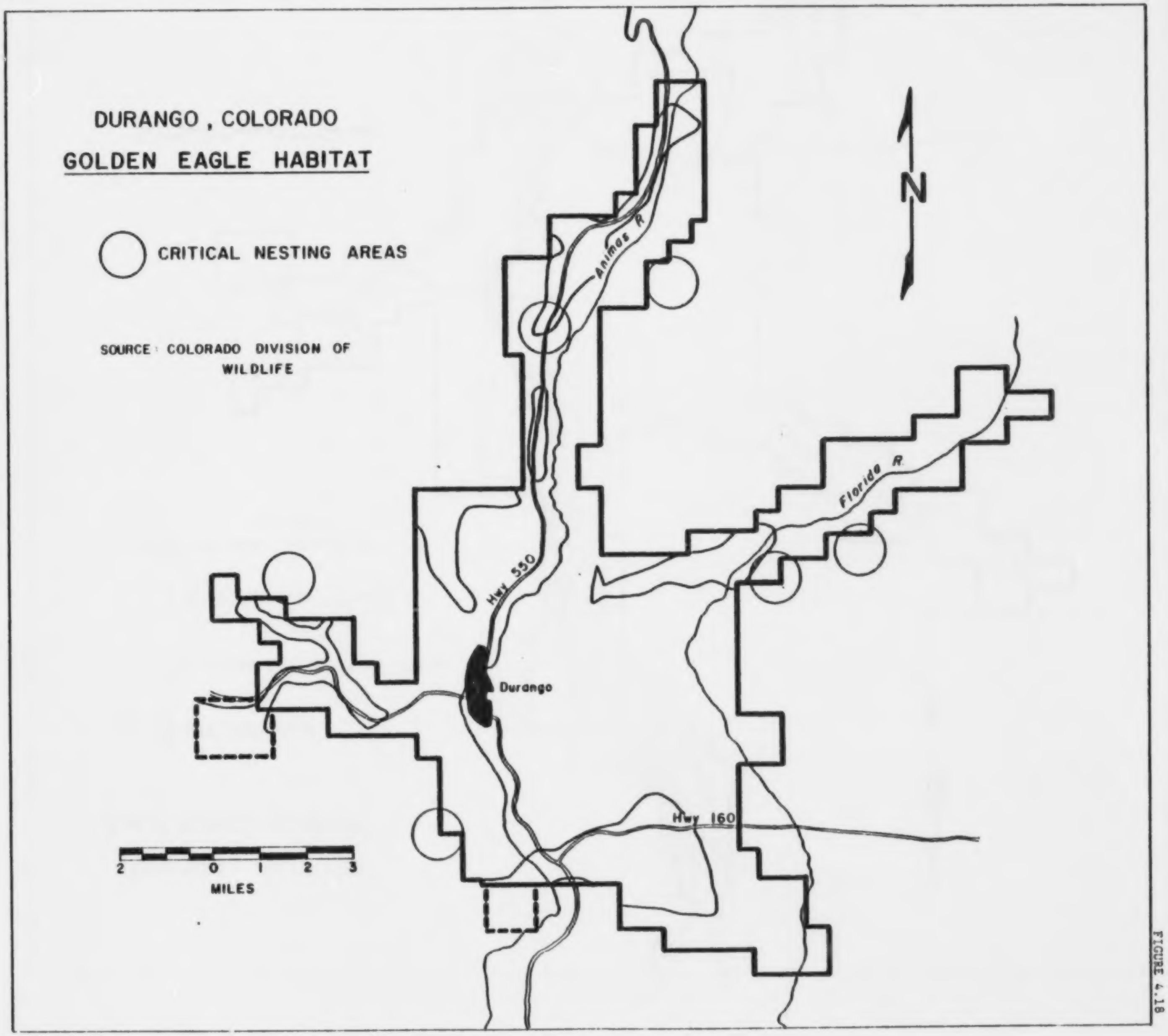

DURANGO, COLORADO
BALD EAGLE HABITAT
HUNTING AREA
HUNTING AND NESTING AREA
SUPPLIMENTAL RANGE
SOURCE: COLORADO DIVISION OF WILDLIFE
N
Animas R.
Florida R.
Hwy 550
Durango
Hwy 160
2
0
1
2
3
MILES

FIGURE 4.17

FIGURE 4.18



DURANGO, COLORADO

GOLDEN EAGLE HABITAT

○ CRITICAL NESTING AREAS

SOURCE: COLORADO DIVISION OF WILDLIFE

N
Animas R.
Florida R.
Hwy 550
Durango
Hwy 160
2 0 1 2 3
MILES

Threatened and Endangered Species

One Federally endangered, one Federally threatened, and one state endangered species potentially occur within the Study Area.

The peregrine falcon has been federally classified as endangered. It is know to exist in the vicinity of the Study Area and one pair of birds was observed west of Durango in 1974 and 1975. Recently the U.S. Fish and Wildlife Service has introduced young captive-bred peregrine falcons at the sites shown in Figure 4.16. Requirements for suitable eyries are precipitous cliffs having several ledges, potholes, or small caves in the cliff face to serve as suitable nest sites. Hunting habitat includes areas which serve to concentrate or support prey species (primarily small-to-moderate-sized birds) and must provide suitable prey exposure for aerial attacks. In the Study Area the Animas River Valley, the Lightner Creek Valley, and the Dry Fork area provide these criteria.

The bald eagle, Federally classified as threatened, is a common winter resident of the area. The preferred habitat of this species is along streams and at large lakes and reservoirs.

The lynx is classified as endangered by the state of Colorado. It is a secretive predator primarily found in spruce-fir forests above 9500 feet. Colorado Division of Wildlife distribution maps indicate lynx may occur in the mountains north of Durango. These animals have large ranges and may occasionally wander into the Study Area.

Currently, there are no known threatened or endangered species of plants in the Study Area.

METEOROLOGY AND AIR QUALITY

Meteorology

A weather reporting station has been maintained at Durango since 1931 and is the source of information for the istics of the area.

The Durango area has a relatively cool climate due to its elevation and its topographic orientation. The annual average daily maximum temperature is 63.3°F and the annual average daily minimum temperature is 29.1°F. Highest average monthly temperatures occur during July and August (average monthly mean about 66°F) and the lowest average monthly temperatures occur in December and January (average monthly mean about 27°F). On an annual average basis, approximately 209 days have minimum temperatures of 32°F or less; only 12 days experience maximum temperatures of 90°F and above. Between 1931 and 1973, temperature extremes ranged from a low of -30°F recorded on January 13, 1963 to a high of 101°F recorded on July 5, 1973.

Snow occurs during every month except for June, July and August. Typically the Durango area receives approximately 63 inches per year with the greatest amounts occurring during December, January and February. The average annual precipitation is 18.7 inches which is typical of semi-arid environments. The driest months are June and November and the wettest is August. Afternoon thundershowers during the summer are characteristic of the area. The local topography causes large variations in weather within short distances and occasionally heavy thunderstorms cause damaging localized floods in small watersheds. Precipitation generally increases and temperature decreases with increasing altitude, but these variations are modified by the orientation of mountain slopes to the prevailing air currents and the effect of the topographical features in creating local air movements.

Prevailing winds which are predominately from the west provide cool temperatures during the summer and abundant moisture supplies for snow during the winter. Cold arctic air masses flow down from the north beginning in the late fall and continue into the spring.

Air Quality

Only limited quantitative information is available for air quality in the Durango Valley. The only air sampling instrument presently operated in the area is a high volume sampler in downtown Durango. Routine measurements are taken for total suspended solids (TSP), sulfates, and nitrates. Sulfate and nitrate concentrations are quite low - well below the State mean. However, TSP concentrations are typically near the established standard of 75 mg/m^3 (annual average). In 1979 annual geometric mean TSP concentrations exceeded the standard, while in the three previous years they were 70, 70 and 71 mg/m^3 respectively (Haig 1980, pers. comm.). The Colorado Air Pollution Division anticipates continued monitoring of TSP concentrations but not of sulfates and nitrates.

Air quality is generally considered good and there are no current air quality problems except for TSP concentrations. The source(s) of this material is unknown. Smoke from fireplaces and stoves is a possible source of suspended solids. Particulates also may come from mud carried to paved roads in the city during the winter and spring from unpaved county roads and driveways. After drying on the pavement, strong winds suspend the fine particles.

ENERGY RESOURCES

Energy resources in the Durango area include electricity, natural gas, and coal. The predominant form of power is electrical energy, which satisfies about 60 percent of the area's energy needs. There are no significant electrical generating facilities in the Study Area; power is purchased from the Upper Colorado Grid System. Demand for electrical power is increasing at a rate of about seven to eight percent per year, and anticipated demand for the next five years is expected to increase about 20 percent (Murphy, 1980, pers. comm.). Such growth is considered to be normal for the area. Recently constructed electrical generating plants in Hayden, Montrose, and Craig will satisfy present and near future electrical demands. Most of the remaining non-transportation energy needs are satisfied by natural gas. However, coal, a major mineral export, is becoming increasingly important as a source of domestic heating.

TRANSPORTATION

Durango is the primary metropolitan center of the San Juan Basin. It lies at the crossroads of U.S. Highways 550 and 160, and the Navajo Trail Highway, all of which are all-weather roads. Public transportation in the area is provided by the Trailways Bus Company and three commercial airline companies, Inter-Mountain Airways, Western Airlines, and Frontier Airlines. The county has no rail freight service.

However, there is a lack of major transportation links which may impose some restrictions on the growth potential of the Durango area and La Plata County. While good quality highways do traverse the county, movement can be interrupted regularly during the winter months. The Durango area does not lie on a major transportation route connecting larger metropolitan areas; as a consequence, transportation of goods into and out of Durango tends to be expensive. The resulting high local costs of various goods may operate as a disincentive for all but local resource-based industries to locate in the area.

LAND USE PLANNING CONSIDERATIONS

There are three types of land use controls in the Durango area of La Plata County: 1) the San Juan Basin Health Unit regulation that lots plotted since 1972 in unsewered areas be at least three acres in size; 2) the La Plata County Comprehensive Plan (LPCCP), still in preparation, which includes "desired growth patterns" for the areas around Durango; and 3) the Land and Resource Management Plan (LRMP) which sets forth policies and performance standards for development. The La Plata County Comprehensive Plan's desired growth patterns designate areas that may be developed, with stipulated maximum densities ranging from an urban character of development to one dwelling unit per forty acres. "Desired growth plans" have been adopted for four of the six planning sectors in the county. These desired growth plans are mandated for review every year; thus, while they do define the current development guidelines, the guidelines cannot be regarded as unalterable. Desired growth patterns for the six Study Areas are shown in Figures 4.19 through 4.23. Undesignated (white) areas on these figures have a maximum allowable density of one unit per 35 acres as designated in Colorado House Bill 1041.

Land use planning is a controversial issue in La Plata County. The LRMP is presently the subject of a number of lawsuits and land use decisions by locally elected officials have been the subject of vigorous debate in the Study Areas. Therefore, while land use planning factors for each area are discussed below, they should be viewed in perspective with the controversial nature of these issues.

Hermosa

The recommended desired growth plan has an urban center at Hermosa with residential development at densities ranging from one living unit per acre to one unit per forty acres through the remainder of the valley. Because the land use planning process and the current land use regulations are being contested, it is not certain whether they will be enforced in the future. If the regulations are set aside, the active opposition of Animas Valley and Hermosa residents to increased density in the area may have some effect on limiting the amount of future development.

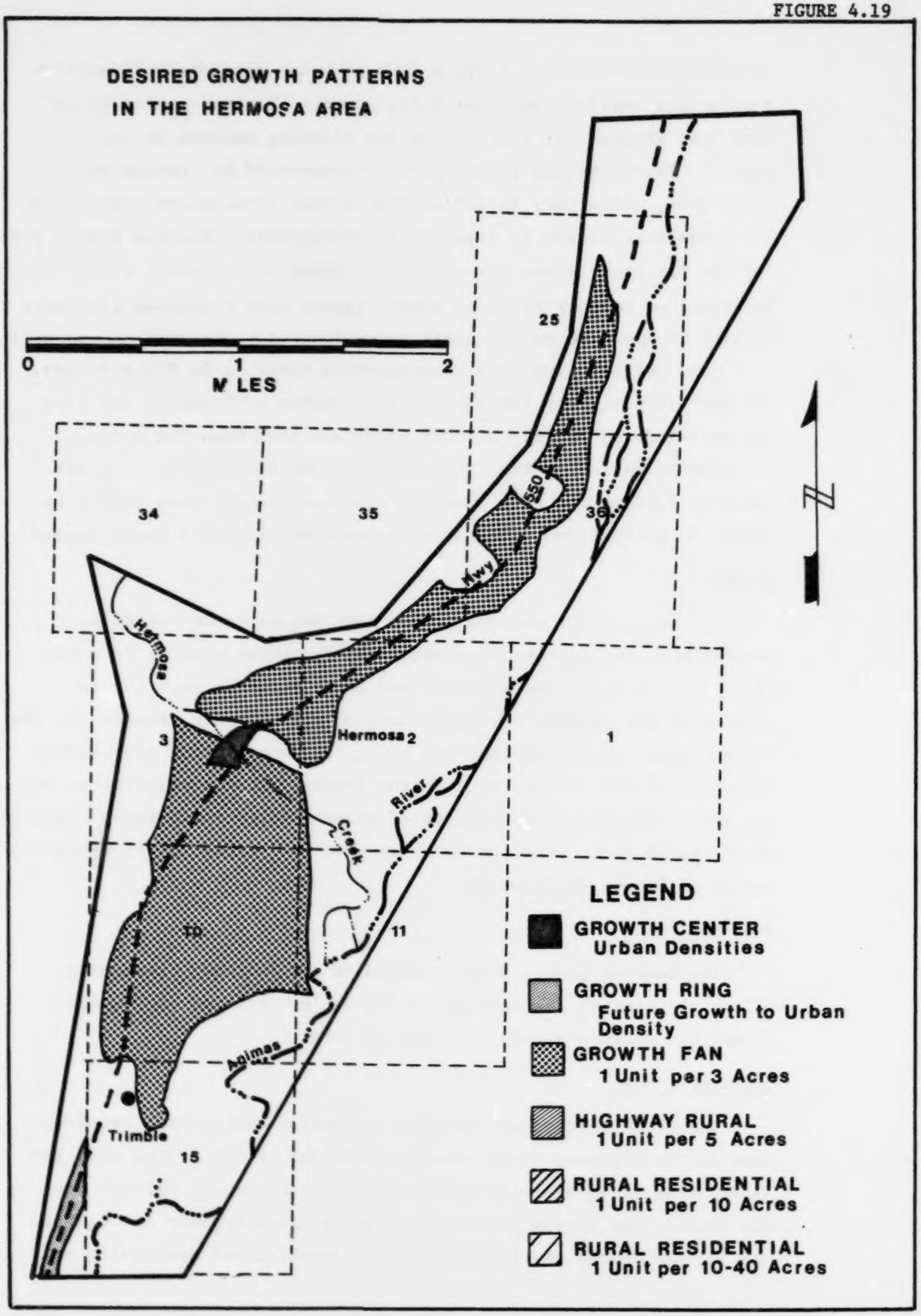
Junction Creek

The desired growth plan adopted in the Junction Creek area allows residential development in the valley portions of the area at maximum density of one unit per 10 acres.

Lightner Creek

The LPCCP desired growth plan designates residential development in the Lightner Creek area at densities of one living unit per three acres along Highway 160 between Durango and the Wildcat Canyon cutoff, one living unit per six acres along Highway 160 between the Wildcat Canyon and Lightner Valley cutoffs, and one living unit

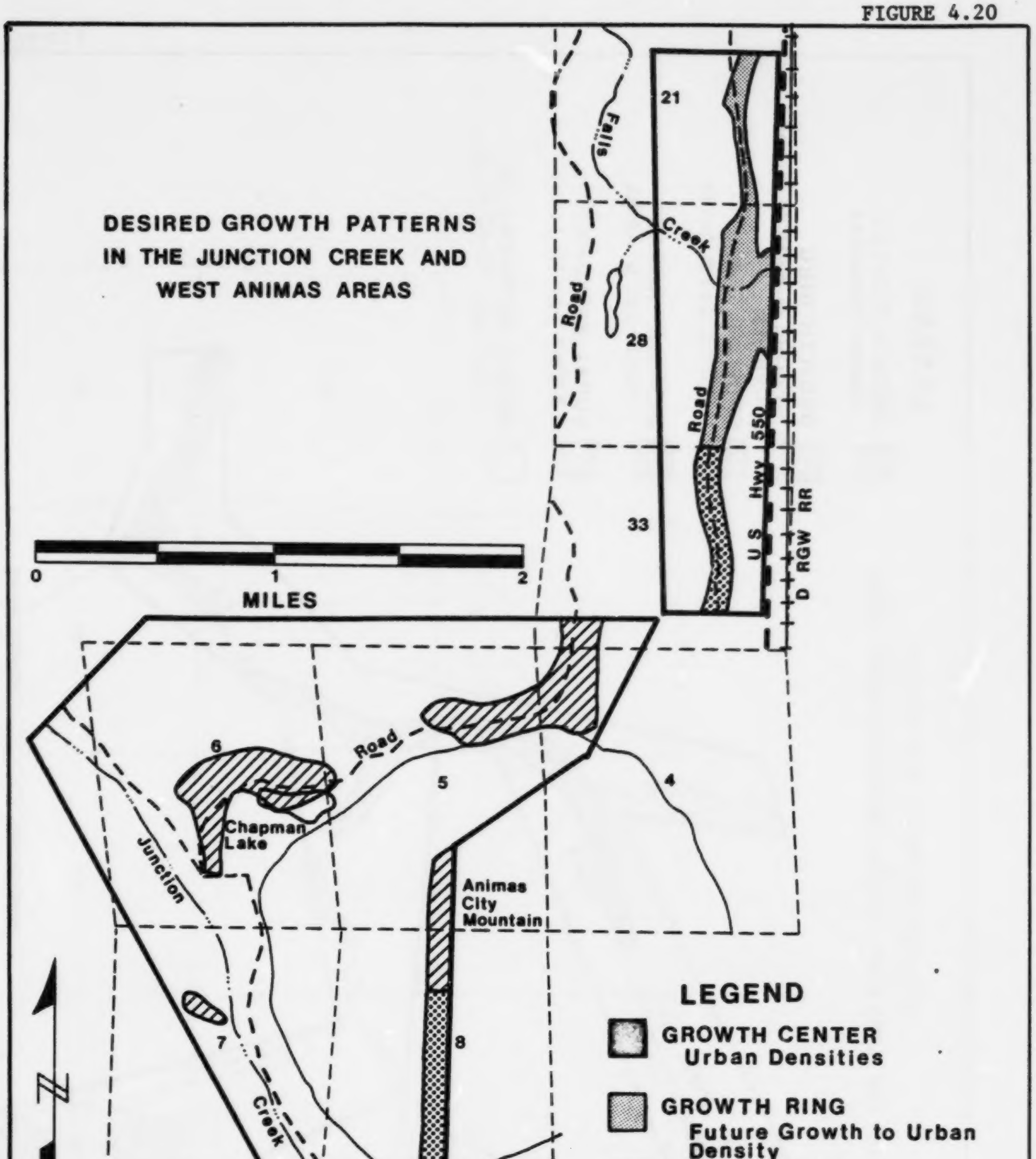
FIGURE 4.19



DESIRED GROWTH PATTERNS IN THE HERMOSA AREA

0
1
2
MILES
25
34
35
36
3
Hermosa
Hermosa 2
1
Creek
River
Animas
Hwy
550
10
11
15
Trimble
N
LEGEND
GROWTH CENTER Urban Densities
GROWTH RING Future Growth to Urban Density
GROWTH FAN 1 Unit per 3 Acres
HIGHWAY RURAL 1 Unit per 5 Acres
RURAL RESIDENTIAL 1 Unit per 10 Acres
RURAL RESIDENTIAL 1 Unit per 10-40 Acres

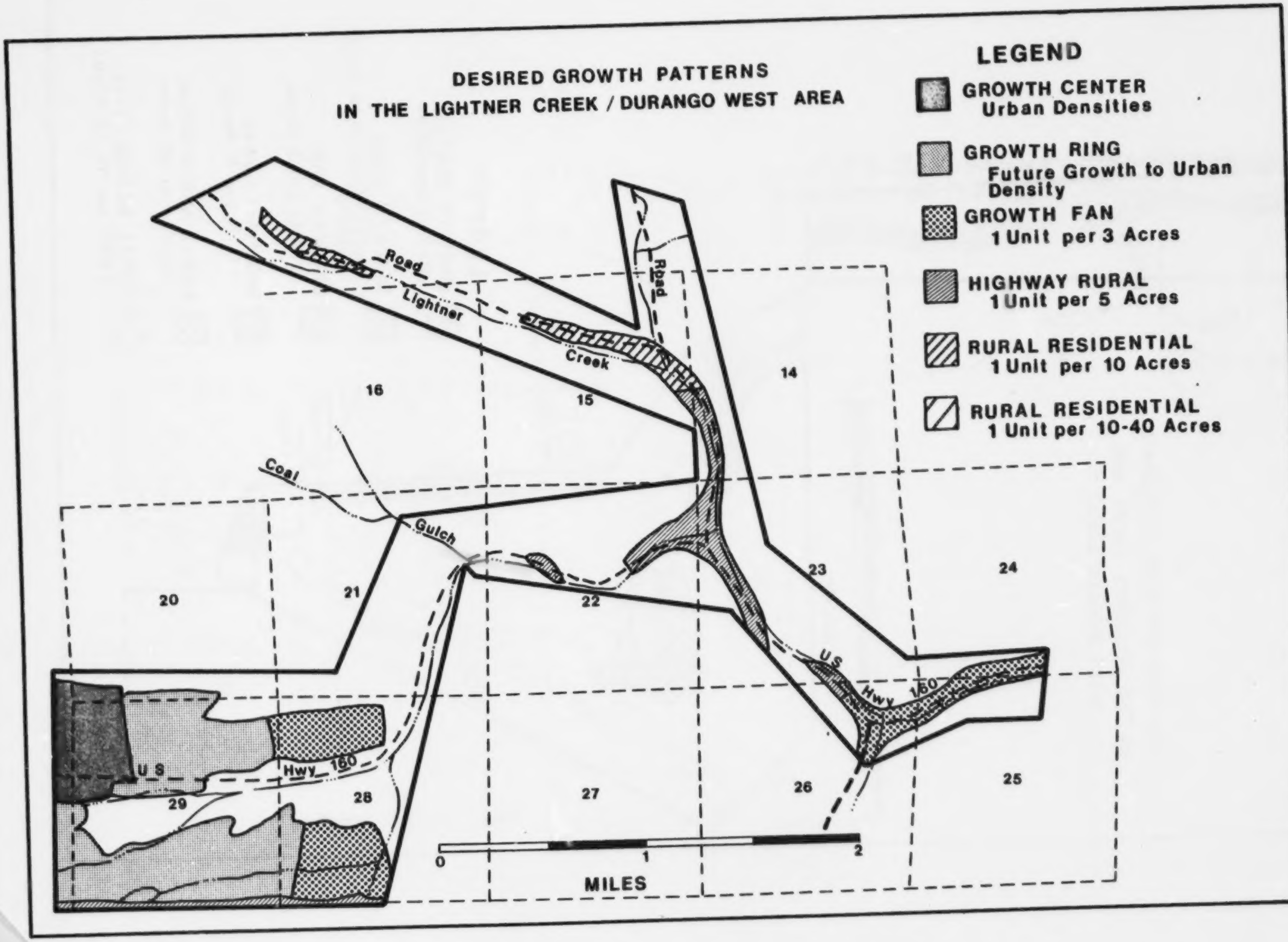
FIGURE 4.20



DESIRED GROWTH PATTERNS IN THE JUNCTION CREEK AND WEST ANIMAS AREAS

0
1
2
MILES
21
Falls
Creek
Road
28
33
Road
US Hwy 550
D RGW RR
6
Road
5
4
Chapman Lake
Junction
Animas City Mountain
7
Creek
8
N
Durango City Limits
18
17
LEGEND
GROWTH CENTER Urban Densities
GROWTH RING Future Growth to Urban Density
GROWTH FAN 1 Unit per 3 Acres
HIGHWAY RURAL 1 Unit per 5 Acres
RURAL RESIDENTIAL 1 Unit per 10 Acres
RURAL RESIDENTIAL 1 Unit per 10-40 Acres

FIGURE 4.21



DESIRED GROWTH PATTERNS IN THE LIGHTNER CREEK / DURANGO WEST AREA

LEGEND
GROWTH CENTER
Urban Densities
GROWTH RING
Future Growth to Urban Density
GROWTH FAN
1 Unit per 3 Acres
HIGHWAY RURAL
1 Unit per 5 Acres
RURAL RESIDENTIAL
1 Unit per 10 Acres
RURAL RESIDENTIAL
1 Unit per 10-40 Acres
Road
Lightner
Creek
Road
Coal
Gulch
US
Hwy
160
US
Hwy
160
14
15
16
20
21
22
23
24
25
26
27
28
29
0
1
2
MILES

FIGURE 4.22

DESIRED GROWTH PATTERNS
IN THE GRANDVIEW/LOMA LINDA STUDY AREA

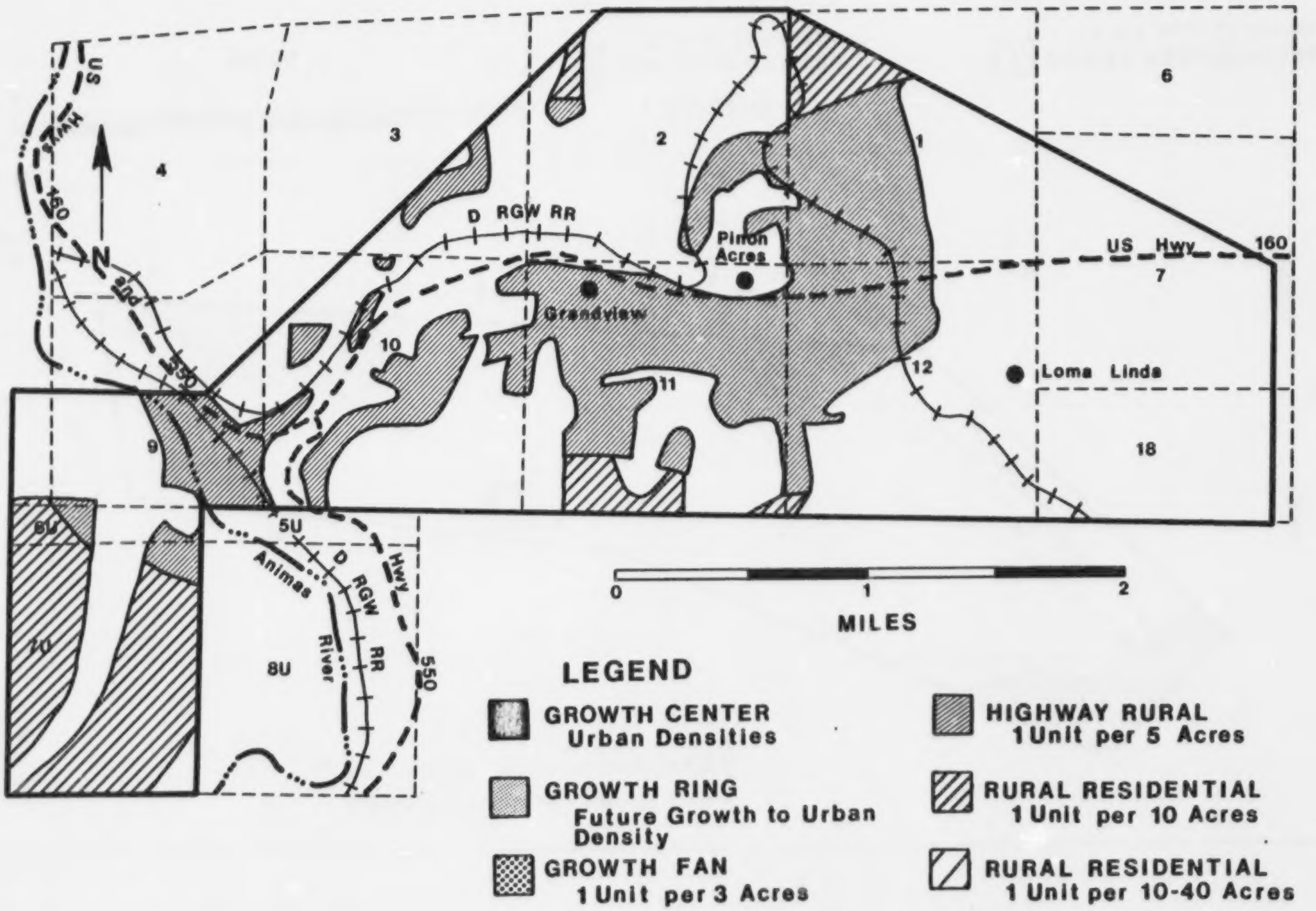
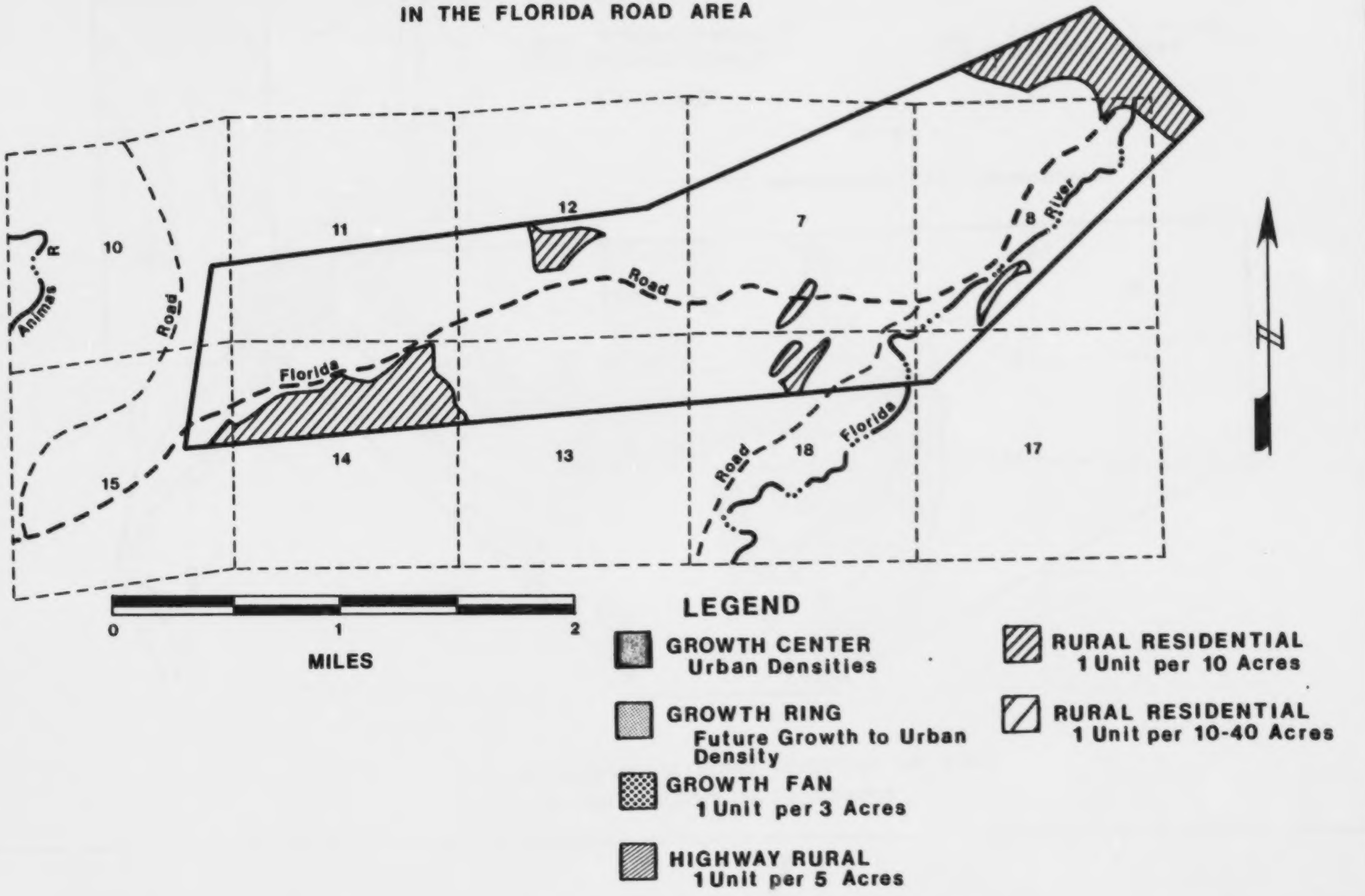

US Hwys 160
N
550
3
4
2
1
6
7
9
10
11
12
18
8U
5U
10
D RGW RR
Pinon Acres
Grandview
Loma Linda
US Hwy 160
Animas River
D RGW RR
Hwy 550
0
1
2
MILES
LEGEND
GROWTH CENTER Urban Densities
GROWTH RING Future Growth to Urban Density
GROWTH FAN 1 Unit per 3 Acres
HIGHWAY RURAL 1 Unit per 5 Acres
RURAL RESIDENTIAL 1 Unit per 10 Acres
RURAL RESIDENTIAL 1 Unit per 10-40 Acres

FIGURE 4.23

DESIRED GROWTH PATTERNS
IN THE FLORIDA ROAD AREA


10
11
12
7
8
15
14
13
18
17
Animas R
Road
Florida
Road
River
Florida
Road
0
1
2
MILES
LEGEND
GROWTH CENTER Urban Densities
GROWTH RING Future Growth to Urban Density
GROWTH FAN 1 Unit per 3 Acres
HIGHWAY RURAL 1 Unit per 5 Acres
RURAL RESIDENTIAL 1 Unit per 10 Acres
RURAL RESIDENTIAL 1 Unit per 10-40 Acres

per 10 acres further into the valley along County Road 207.

The plan shows part of Durango West as a growth center, defined as "an established center that contains urban densities and uses". The area around the growth center is planned for densities categorized as growth ring (future development for urban densities and uses), growth fan (one living unit per three acres) and highway rural (one living unit per six acres). The latter category includes only a small amount of land within the Study Area.

Grandview-Loma Linda

The adopted desired growth plan for the Grandview-Loma Linda area provides two types of residential densities: 1) "highway rural", with a density of one living unit per six acres, along Highway 160, and 2) "rural residential", with one unit per 10 acres, along County Road 213. Portions of the area not included in either of these categories are classified as "irrigated", a designation which presumes agricultural use and makes development more difficult.

Florida Road

In the adopted desired growth plan, a small portion of the western boundary of Florida Road is included in the growth ring that surrounds the City of Durango. While no specific densities are defined in that area, it is characterized as a "future development area for urban uses and densities". The center portion of the area is designated on the sector plan as a growth fan, with a maximum density of one living unit per three acres. The eastern part of the area and all other developable portions are designated for highway rural densities of one living unit per six acres.

West Animas

The proposed desired growth plan for the Animas Valley allows residential development in the West Animas area at a density of one living unit per acre.

Other Land Use Planning Considerations

Future population growth and land development in La Plata County will not be limited to the six areas defined in the 201 wastewater facilities planning process. The Comprehensive Plan estimates that 2,800 additional dwelling units will be located in Durango by the year 2000. Because the City of Durango has few development sites within its current boundaries, most of this development will occur on unincorporated private lands near the City. The approved Riverside complex northeast of Durango will ultimately include 1,038 living units. Approximately 200 units are planned in Hillcrest Mesa near Fort Lewis College, while about 100 units are planned along Florida Road. There are several other development projects in the area that are in various stages of planning.

Privately owned lands north of Hermosa along U. S. Highway 550 have recently experienced rapid development as both recreational and residential areas. An additional 1,080 living units have reportedly been approved for the Purgatory ski area located 10 miles north of Hermosa. Tamarron, just south of Purgatory, plans to build up to 400 units by 1990 (Neal, 1980, personal communication). Additional land is available along the U.S. Highway 550 corridor for perhaps 200 high density dwelling units (Yates 1980, personal communication).

EXISTING AND PROJECTED POPULATIONS

EPA's policy for planning local and regional wastewater facilities is to use population forecasts that are consistent with adopted state forecasts and national forecasts by state prepared by the U.S. Department of Commerce, Bureau of Economic Analysis for EPA in 1978. It is also the policy of EPA that wastewater facilities plans be consistent with water quality management plans prepared under Section 208 of the Clean Water Act, local land use plans and policies. These policies are intended to avoid wasteful expenditures of public funds which might result from oversizing or from construction of wastewater facilities in areas not planned for or suitable for development. This EIS therefore presents data on recent and future growth in La Plata County and discusses available population forecasts.

Existing Conditions

La Plata County, with a 1978 population of over 25,000, has grown steadily during the decade of the 1970's, showing an eight-year population increase of 31 percent. Most of this growth took place outside the City of Durango, which grew only nine percent over the same period. Recent population and growth data for La Plata County and Durango are summarized in Table 4.2. These statistics reflect permanent residents. The overall level of population for facility planning purposes is higher because of part-time residents and tourists.

TABLE 4.2

RECENT POPULATION GROWTH IN
LA PLATA COUNTY AND DURANGO

	1970	1978	1980	Growth 1970 to 1978
La Plata County	19,199	25,101	-----	31%
Durango City	10,333	11,245	-----	9%
Durango as Proportion of La Plata County	54%	45%	-----	---

Source: U.S. Census of Population, 1970, 1978, and 1980.

The current population estimates of the six wastewater Study Areas are summarized in Table 4.3.

TABLE 4.3

POPULATION ESTIMATES OF THE STUDY AREAS

Study Area	Estimated 1980 Population[1]	Percent
Hermosa	1700	36.7
Junction Creek	250	5.4
Lightner Creek	960	20.7
Grandview-Loma Linda	1200	25.9
Florida Road	283	6.1
West Animas	240	5.2
Total	4633	100.0

1. Source: Allen, 1980

Some of the forces encouraging growth in the recent past will continue to operate in the future, and new forces may also materialize. The factors most likely to encourage future growth include increased tourism, energy resource development (oil, gas, coal, geothermal), and expanded irrigated agriculture. While these are factors that are known to contribute to future growth in the Durango area, it is not possible to determine how they may influence growth in the six areas addressed in the Facilities Plan.

Population projections for the six development areas have been developed under a base case condition. Base case conditions are equivalent to a no action alternative and assume that existing wastewater management will not be an inducement to growth. The 20-year population projections for the six sub-areas are presented in Table 4.4. Low, medium, and high projections for each area are provided; the basis for each is explained in a footnote to the table. If no facilities are built it is estimated that between 3,660 and 7,810 additional residents will locate in the six Study Areas by the end of the planning period (Gruen & Gruen, 1980). Further discussion of population projections is presented in Appendix A.

TABLE 4.4

PROJECTED POPULATION INCREASES FOR DURANGO 201 STUDY AREAS

(Increases during 1980-2000 if no wastewater facilities projects are implemented)

Area	Estimated 1980 Total	Projected Increases Low	Medium	High
Hermosa[1]	1,700	750	1,275	1,500
Junction Creek[2]	250	180	300	450
Lightner Creek/Durango West[3]	960	1,950	3,315	3,700
Grandview/Loma Linda[4]	1,200	420	600	900
Florida Road[5]	283	80	135	360
West Animas[6]	240	280	450	900
TOTAL	4,633	3,660	6,075	7,810

[1] Based on current approval of 550 unbuilt dwelling units: low projection assumes 50% build-out; medium projection assumes 85% build-out; high projection assumes 95% build-out. All projections assume 3.0 persons per household.

[2] Low projection assumed 3 dwelling units/year build-out; medium projection assumes 5 dwelling units/year building-out; high projection assumes 30% of 503 planned units are built (note that only 287 units are currently approved).

[3] Based on current approval of 1,300 unbuilt units in Durango West: low projection assumes 50% build-out; medium projection assumes 85% build-out; high projection assumes 95% build-out. All projections assume 3.0 persons per household.

[4] Low projection assumes 7 dwelling units/year build-out; medium projection assumes 10 units/year build-out; high projection assumes 15 units/year build-out.

[5] Low projection assumes build-out of 30% on existing vacant lot; medium projection assumes build-out on 50% of existing vacant lots; high projection assumes build-out of 6 units/year.

[6] Low projection based on completion and 100% occupancy of Waterfall Village; medium projection based on completion and 100% occupancy of Waterfall Village plus one similar project plus a few miscellaneous other units; high projection based on completion and 100% occupancy of three Waterfall Village-type developments.

Source: Gruen Gruen + Associates

SOCIOECONOMIC CONSIDERATIONS

In addition to population growth projections and land use planning objectives, other socioeconomic considerations of importance include land availability, land prices, existing local infrastructure, and future regional and site-specific developments.

The relative prices of land in various areas play a part in determining where people live. Presented in Table 4.5 is a summary of land prices in the six EIS Study Areas as of May, 1980. To some extent, price differences reflect the presence or absence of amenities; for example, Durango West, with lots priced at $12,000, has paved streets with curbs and gutters, central water and central sewage treatment. The availability of land for private ownership establishes a geographic limit to the locations of future residential development, and the relative prices for land begin to suggest the potential attractiveness and affordability of various areas within the geographic limit.

Both the existing and proposed major residential developments within the study areas are summarized in Table 4.6. In the Hermosa, Lightner Creek, and Florida Road areas, there are no existing institutional development constraints and the projects are progressing toward completion. However, there are varying degrees of uncertainty associated with some of the other proposed developments.

Proposed projects in the Junction Creek area have shown little recent development activity and there are road access problems to some areas. However, several other plans for additional condominium complexes are being considered for Durango Estates, near Chapman Lake, and other area.

The proposed new development for Grandview-Loma Linda is probably still considerably in the future. Development of the Animas Airpark would occur following construction of a proposed shopping center south of Durango and expansion of the industrial park.

TABLE 4.5

COMPARATIVE SAMPLE LAND PRICES IN THE EIS STUDY AREAS

Area	Price Per Acre	 Per Lot	Average Lot/Parcel Size
1. Hermosa	$12,000-14,000		0.5 to 6 acres
		$8,000-10,000	0.5 acre
	$8,000		23 acres (1 parcel)
2. Junction Creek	$2,000-2,500		0.5 to 2 acres
3. Lightner Creek	(Too few sales to generalize)		
Durango West		$12,000	0.4 acre
4. Grandview-Loma Linda	$3,500[a]		unknown
5. Florida Road	$5,000-6,000		unknown
		$10,000[b]	3 acres
6. West Animas	$6,000-7,000		unknown

[a] Close to Route 160 or other paved road.

[b] Very hilly terrain.

Source: Clayton Ebel, La Plata County Assessor, personal communication.

TABLE 4.6

EXISTING AND PROPOSED MAJOR DEVELOPMENTS IN THE STUDY AREAS

Major Developments by Area	Proposed Number of Units
Hermosa	
Blue Sky	200
James Ranch	288
Hermosa Townhouses	110
Subtotal	598
Junction Creek	
Durango Estates	407
Jacob's Cliffs	180
Sailing Hawks	16
Subtotal	503
Lightner Creek	
Durango West	1200-1300
Grandview-Loma Linda	
Animas Airpark	39
Florida Road	
Florida River Estates	120
West Animas	
Waterfall Village	90
Total	2500-2650

The one pending major development in the West Animas area, Waterfall Village, has been approved by the La Plata County Commissioners. However, its development has been delayed as a result of the ban on new package plants. Its ultimate development will depend on the resolution of water quality problems in the Animas River above the City of Durango's raw water intake points.

CULTURAL RESOURCES

Various Indian groups inhabited the area from early history. The extensive archeological ruins of cliff dwelling tribes at Mesa Verde, 36 miles southwest of Durango, are the most famous Indian relics in the region. Subsequent Hispanic exploration and settlement is reflected in the Spanish names of numerous local landmarks.

A mining boom hit the area in the mid-1800's following the discovery of precious metals. Increased settlement and trade encouraged the development of transportation systems. The Kansas to California "Navajo Trail" passes through Durango. The Denver and Rio Grande Narrow Gauge Railroad between Durango and Silverton is a Registered National Historic Landmark. Several historic buildings from this era are probably eligible for inclusion in the National Register of Historic Places.

During the first half of the 20th century agriculture provided a marginal to stable living for residents. During the 1950's discoveries of energy and mineral resources expanded the population, but agriculture provided the underlying stability to the economy. During this period Durango also prospered from increases in tourism, recreation related service industries, retail sales, and real estate expansion. Population increases have continued into the 1970's because of a westward movement of the nation's population and the increasing popularity of the southwest.

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

This chapter presents information on the environmental consequences of the wastewater management alternatives developed in the Facilities Plan for each of the six Study Areas. All alternatives will be addressed (as required under Section 1502.16 of the NEPA Regulations), although emphasis will be given to the recommended alternative for each Study Area.

This chapter is organized into nine sections. The first six sections present for each of the Study Areas a brief analysis of the significant potential beneficial and adverse impacts of the wastewater management alternatives, as well as possible mitigation measures. More detailed information regarding impacts and mitigation is presented in Appendix B.

Information in the first seven sections may be regarded as combined discussions of two of the elements required by NEPA Section 102 (2)c: environmental impacts of the alternatives, and any adverse environmental effects which cannot be avoided. The remaining two elements of NEPA Section 102 (2)c, (i.e., the relationship between local short-term uses of man's environment and the maintenance of long-term productivity and irreversible environmental changes of the proposed action) are addressed in the remaining two sections of this chapter.

This organizational arrangement results in some repetition of impact discussions common to two or more of the Study Areas. However, it facilitates review by Study Area residents of the impacts associated with alternatives for each of the respective Study Areas and thereby is aimed at facilitating public understanding of the environmental consequences of decisions affecting each of the Study Areas and the planning area as a whole. The detailed impact analysis for each Study Area presented in Appendix B is organized by technical discipline to facilitate regulatory agency review.

WASTEWATER MANAGEMENT PLANS

The wastewater management strategies developed for each of the respective Study Areas can be divided into three types: (1) No Action, (2) Formation of Maintenance Districts, and (3) Sewers, either with a central treatment facility or with connection to the City of Durango's system. General environmental consequences associated with each of these alternative plans are discussed in the following paragraphs.

No Action

A major impact resulting from the No Action alternative is the continued threat to water quality and public health by continued reliance on existing systems. The sanitary survey conducted in the spring of 1980 (Allen, 1980) indicated several existing package plants and some individual on-site disposal systems were operating inadequately, had histories of failures, and/or were expected to experience failures in the future. Results of the sanitary survey are summarized in Table 5.1.

The threat to water quality and public health resulting from unit failures and/or ground water contamination will continue to exist as long as on-site disposal systems are used. The fact that the most recent water quality study failed to conclusively document contamination does not eliminate the potential for severe public health and/or water quality problems occurring in the future. Pathogens in inadequately treated wastewaters are known to cause diseases such as typhoid, paratyphoid, bacillary dysentery, cholera, poliomyelitis, and infectious hepatitus. Protection of ground water resources is especially important since many of the areas are dependent on ground water for domestic water supplies, e.g., Junction Creek, Lightner Creek, Grandview/Loma Linda. Nutrients and suspended and dissolved solids in inadequately treated wastewater can cause algal blooms, degrade aesthetics, and be harmful to aquatic organisms.

Since the sanitary survey was conducted, many of the package plants and individual units have been repaired, upgraded, and/or replaced. Also, many systems which have a history of failures had been repaired and appeared to be operating adequately at the time of the survey. In the many cases in which the existing package plants or individual on-site systems appear

TABLE 5.1

SANITARY SURVEY RESULTS[1]

Area	Package Plants and Multiple Customer Facilities			Individual Systems		
	Units Examined	Units With[2] Problems or Potential Problems	Percent with Problems	Units Examined	Units[3] with Problems	Percent with Problems
Hermosa	19	13	68	35	11	31
Junction Creek	1	1	100	25	5	20
Lightner Creek	5	5	100	13	2	23
Grandview/Loma Linda	18	11	56	37	7	19
Florida Road	1	1	100	25	3	12
West Animas	2	1	50	5	2	40
	46	31	67	140	30	21

[1] Source: Allen 1980

[2] This includes systems with history of problems, needing repairs, emitting odors, and for which problems are anticipated because of equipment, expected loadings, or location.

[3] This includes systems needing repair, high ground water noted, history of problems, or for which problems are anticipated.

to provide an adequate method of disposing of wastewaters, increases in ground water levels and/or population density could render such systems unsuitable in the future.

Another consequence of the No Action alternative is the continued requirement of septage handling. Septage can severely shock-load treatment plants if not added to the waste stream in small amounts. Existing septage volumes generated in the Study Area may be in excess of 6,000 gallons per day, which is enough volume to upset Durango's proposed treatment plant should it be emptied directly into the facility.

The significance of the septage handling requirement is difficult to assess given the overall hauled waste problem in the Study Area. Even with implementation of sewers in Hermosa, Grandview/Loma Linda, and Junction Creek, the hauled waste volume will not be significantly reduced. At maximum, 40 multiple customer facilities and approximately 340 individual systems would be retired. This results in a decrease of from 798,000 gallons per year (No Action) to 702,400 gallons per year (Sewers) or a net reduction of 95,600 gallons per year (12 percent decrease) (Allen 1980).

Formation of Maintenance District

Implementation of a Maintenance District continues to rely on individual on-site systems and package plants, but places the responsibility of maintaining these systems with an appropriate governmental agency. Under authority of this agency, existing systems would be upgraded as appropriate and a monitoring program and reporting system would be established. The Maintenance District envisioned for the individual Study Areas would involve a one - or two-person staff. District purchases might include: septage pumping equipment, chemical testing apparatus, maintenance tools, and vehicles. Of primary importance in this alternative is the hiring of a competent or trained operator to maintain the multiple customer facilities and individual plants.This would be a full-time position for an individual certified by the Colorado State Department of Health with a Class C Operators License minimum (Class B preferred). This employee would be responsible for record keeping, sampling, and monitoring of plant operations, as well as routine pump, blower and system maintenance and clean-up duties. The district would be embodied with authority for performance of the following duties:

1. Insure that the system which is suggested for use on a particular parcel, or parcels, of property be the system best suited to the waste flow, soil, slope, and drainage aspects of the property (or properties), such that the system will properly treat and dispose of the waste without presenting a health or water quality hazard.

2. Insure that during the installation of the system all due care is given to the proper construction of the system so that the development of a system's malfunction due to improper installation is avoided during the projected operating life of the system.

3. Insure that during the operating life of the system, proper maintenance of the system is achieved and optimal functioning of the system is provided.

4. Insure that the total effects of the operations of the sum of the systems within the boundaries of the district are not degrading the quality of the environment.

5. Insure that if a system malfunction occurs, the necessary powers and capabilities for prompt correction of the malfunction are at hand and applied.

Environmental impacts associated with this wastewater management plan are similar to those described for the No Action alternative, except the threat to public health by ground water contamination or by inadequately treated wastewaters being released on the surface is considerably reduced due to more frequent pumping of septage tanks, better operation of package plants, and an expanded monitoring program.

An important impact resulting from implementation of a Maintenance District is the financial burden imposed on owners of systems which are presently operating adquately but who will be required to contribute financially to the support of the District. In effect, owners who are conscientiously maintaining their own systems will be required to subsidize the maintenance of owners of faulty and poorly operated systems.

The Maintenance District alternative presented in the Facilities Plan envisions separate Districts for each of the six Study Areas. The concept of a Study Area-wide or county-wide District was eliminated early in the facilities planning study even though such a concept might realize some economies of scale for capital expenditures. Reasons for the elimination of a Study Area-wide Maintenance District include the following:

1. Inequitable division of capital improvement expenditures between Study Areas and plants within Study Areas resulting from wide variation in needs among plants to upgrade,

2. Many owners of existing package plants are licenced operators who run plants themselves and thus are incurring no or minimal operating costs but would be required to support a Maintenance District operator, and

3. Nondischarging plants which presently have minimal maintenance costs would be required to contribute to support of a Study Area-wide Maintenance District.

Sewers

The single most important beneficial impact resulting from implementation of sewer alternatives is the enhanced safeguards to public health and water quality. Elimination of individual on-site disposal systems and many of the package plants in the Study Area will greatly reduce the threat of contamination of the water resources in the area. It should be noted that treatment facilities proposed in the Facility Plan will not remove many of the chemical constituents in wastewater. Only tertiary treatment will remove these nutrients. The major water quality improvements will result from reduction of organic materials, other suspended and dissolved solids, coliform bacteria, and other microbes.

One of the most important issues associated with installation of sewers in the Study Area is the potential effect on growth rates and distribution patterns. Development patterns are restricted throughout the Study Area by physical constraints such as flood plains and steep slopes. In those areas suitable for development, institutional constraints influence growth patterns. For example, the Colorado Health Department requires at least three acres of land per dwelling unit in unsewered areas to accommodate on-site disposal systems. The availability of sewers may relax this constraint on growth and may facilitate high density growth and strip development along pipeline alignments. Desired growth patterns have been adopted by the Planning Commission for four sectors (planning regions) of the Study Area. However, land use ordinances are subject to annual review. County planning documents recognize environmentally sensitive areas but the County Commission mades decisions on a case-by-case basis. Development in environmentally sensitive areas is not always prohibited. Thus the possibility exists that future growth in the Study Area may adversely affect such sensitive resources as prime agricultural land in the Hermosa, West Animas, and Grandview/Loma Linda areas and wildlife resources in portions of the Study Area. No erosion control ordinances are in effect in the Study Area, thus, mitigation to growth related impacts will not be provided. In view of the competing interest regarding land use management practices in the Study Area, the issue of growth facilitation resulting from sewer installation is considered significant.

The overall impact of sewers on population growth and land use change in the six Study Areas is variable and depends, in part, on the natural attractiveness of the areas in question. Without sewers, the development potential and the relative attractiveness of each area would remain as they are now. Durango West and the locations near the city but outside the 201/EIS Study Area(Riverside, Hillcrest Mesa and the close-in areas on Florida Road) would be the most probable high-growth areas, with capacity for approximately 8,000 of the 20,000 new residents of La Plata County expected between now and the end of the century. The Hermosa area, another attractive location, could take another 1,000 to 1,500 residents in the development already planned. Edgemont Ranch would be another likely growth area if and when it develops, with room for an estimated 1,500 residents as well. Together, these areas would accommodate an estimated 11,000 new residents, or almost 60 percent of the expected countywide population increase.

The implementation of a sewer system in the Grandview-Loma Linda Study Area would have the greatest potential impact on the future distribution of population and land use, because it would remove a major development constraint there. The combination of wastewater facilities and level, less expensive land (land prices could, however, be expected to rise somewhat) would make the area an attractive one for new development. If the desired growth pattern is changed to allow higher density development, Grandview-Loma Linda could become a high-growth area. It is not clear whether the increased development potential and attractiveness in the area would result in a rearrangement of the 11,000 residents expected to locate in the Durango area of La Plata County or would increase the area's share of new county residents; Grandview-Loma Linda would be a feasible alternative for residential location not only to Durango West and Hermosa but also to Bayfield.

Implementation of projects in other areas would increase the development potential but not relative attractiveness of those area. It therefore would result in a marginal amount of additional development - primarily commercial along U. S. Highway 160 in the Lightner Creek area and Waterfall Village in the West Animas area - but not a significant shift in the distribution of population growth.

The issue of who benefits versus who pays is considered significant for sewering alternatives. Sewers will impose an economic burden on all residents, including those who are presently using satisfactory systems but who will be required to connect and/or contribute financially to the new sewer system. The sewering alternatives are designed to correct wastewater management problems caused by a minority of systems which are operating inadequately. These problems are generally more acute with package plant operations than with individual on-site units. Instead of having owners of faulty systems paying for the repair/replacement of their own systems, the sewering alternatives require all residents in proposed service areas, many of which with adequate systems, to support a plan to correct problems created by the minority.

An additional cost which may affect proposed service area residents for alternatives which connect to the Durango System would be in the form of higher taxes resulting from becoming annexed to the City. Connection to the Durango System would most likely fall under the implied consent rules of the City. Implementation of sewers, in this case, may represent an agreement by the residents to be annexed to the City at some future date by accepting City services.

Development within flood hazard areas is an important issue associated with the Facilities Plan. The proposed treatment plant site for Hermosa is located within the 100-year flood boundary. Also, proposed sewer alignments traverse portions of the 100-year flood plain. Some existing developments that will be served by the proposed facilities are located in flood hazard areas (e.g. Hermosa Meadows in Hermosa and the Junction Creek Mobil Park in Junction Creek). Sewers could facilitate development in flood hazard areas unless proper safeguards are instituted. In that regard, EPA is considering the following grant condition to the Facilities Plan:

> The managing agency in conjunction with the other local jurisdictions in the service area for this project shall provide the EPA with documentation that each local jurisdiction in the service area has developed an effective program to control development within the designated 100-year floodplain. At a minimum an effective program must comply with the floodplain management standards of the National Flood Insurance Program including designation and regulation of the floodway. The grantee and local jurisdictions may accept a severage connection from any residential, commercial or industrial structure located within a designated 100-year floodplain if the structure was in existence or was issued a local building permit prior to the date of award of the Step 2 grant of the project.

Installation of sewer lines and treatment facilities will result in construction-related impacts (e.g. noise, dust, erosion hazard, disruption of traffic flow). These impacts are temporary in nature and can be mitigated easily by application of standard engineering techniques. Another potential impact associated with construction activities is the disruption and destruction of cultural/historical resources that may be located within proposed construction areas. This potential impact is considered significant in view of the rich cultural heritage of the Study Area. In this regard, the following grant condition is enacted by EPA:

> No payment in excess of 25 percent of the Step 2 grant shall be made prior to completion of a cultural/historical resources survey that satisfies the requirements of the construction grants program. This condition is designed to provide early identification of any conflicts of the plan with these resources so that alternatives can be investigated before a major commitment of Step 2 funds has been made.

Another significant consequence of implementing sewers is the net reduction in electrical energy consumption. Consolidating wastewater treatment into central treatment plants or to the Durango system eliminates several package plant system, many of which are energy intensive because of over-loading problems. The major reductions in energy use occur in Hermosa, Junction Creek, and Grandview/Loma Linda in which sewers would result in annual energy savings of 206,260 kwhr, 26,280 kwhr, and 28,000 kwhr, respectively.

HERMOSA

Recommended Alternative

The recommended alternative is a central treatment plant with one of three different configurations of pipeline alignments serving different portions of the Study Area. Issues, potential beneficial impacts and adverse impacts resulting from implementation of this alternative are presented in Tables 5.2 and 5.3.

Probably the single most important issue associated with the recommended alternative is its effect on growth in the service area.

Development in the Hermosa area is constrained by both steep slopes on the west and the Animas River flood plain on the east; nevertheless, approximately 600 additional living units are currently planned for the area. This development would nearly double the current populations.

TABLE 5.2

POTENTIAL BENEFICIAL IMPACTS AND ISSUES ASSOCIATED WITH RECOMMENDED ALTERNATIVE FOR HERMOSA AREA

Impacts/Issues	Comments
1. Enhances safeguards to public health and to water quality.	Eliminates continued reliance on package plants which in many cases are at, near, or over design capability. Results of the package plant assessment indicate that of the twelve plants surveyed, seven are presently operating adequately. However, prognosis is poor for continued reliance on such systems. Only three are considered sufficient to provide good future service. Allows sewer connections in those areas employing on-site disposal systems that are presently experiencing and/or are expected to experience problems related to the continued use of such systems. The area is characterized by gravels and high ground water. Of the 35 on-site disposal systems observed in the assessment, three have percolation rates greater than 1 inch per 5 minutes and nine note high ground water.
2. Results in a net reduction in energy usage.	The existing treatment facilities collectively consume about 277,730 kwhr of electrical power annually. Of this total, approximately 234,730 kwhr is used by facilities that will be replaced by the central treatment plant. Power consumption by the proposed central treatment plant is estimated at 28,470 kwhr annually. Considering the energy needs of the new plant and those of existing systems not replaced by the new plant, annual energy consumption is estimated at 71,470 kwhr. This represents a 78 percent decrease in energy consumption in the Hermosa area resulting from implementation of the recommended alternative. In the proposed service area alone the savings is 90 percent.

TABLE 5.2 (continued)

Impacts/Issues	Comments
3. Results in greater reliability of wastewater treatment capability in Hermosa area for improved water quality control.	Regional facility will have (1) better equipment, (2) better and more uniform operator capability, and (3) back-up power supply, i.e., generators, to assure continued operation in the event of a power outage.
4. Release present sewage treatment facilities property to alternative land uses, thereby improving local aesthetic quality in areas near these facilities.	Collectively, approximately five acres of land is presently occupied by existing treatment facilities. Abandonment of systems replaced by the central treatment facility will release 3.5 acres of land. The new treatment facility will occupy three acres of land. The net gain in land is, thus, 0.5 acre. Fifteen of the existing treatment facility sites will be replaced by one large well-managed lagoon facility.

TABLE 5.3

POTENTIAL ADVERSE IMPACTS AND ISSUES ASSOCIATED WITH RECOMMENDED ALTERNATIVE FOR HERMOSA AREA

	Impacts/Issues	Comments
1.	Treatment facility subject to flood hazard. Most of the proposed service area is outside the 100-year flood plain. An exception is the Hermosa Meadows package plant which is vulnerable to flood damage.	The proposed treatment plant site is located within the boundaries of the 100-year flood plain. The 208 Plan recommends against locating treatment facilities in the flood zone. Federal guidelines governing financing the construction of facilities located in flood plains may encumber funding options.
2.	Impose economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to the Hermosa area treatment system.	The issue of who benefits versus who pays is considered significant. The recommended alternative is designed to correct wastewater management problems caused by a minority of systems which are operating inadequately, namely, most of the package plants and a few single-family residences. Instead of having owners of faulty systems paying for repair/replacement of their own systems, the recommended alternative requires all residents in the proposed service area, many of which with adequate systems, to support a plan to correct problems created by the minority. Conversely, however, all residents of the Study Area will benefit by the reduced hazard to public health and water quality resulting from the recommended plan. Estimated costs are as follows: Subalternative 1: User Charge: $5.06-$8.48/month Tap fee: $200-$550 Service hookup: $500-$1500 Subalternative 2: User Charge: $5.42-$8.85/month Tap fee: $200-$550 Service hookup: $500-$1500

TABLE 5.3 (continued)

Impacts/Issues	Comments
	Subalternative 3: User charge: $4.72-$8.44/month Tap fee: $200-$550 Service hookup: $500-$1500
3. Potential for water quality degradation to Animas River via effluent discharge.	The proposed outfall to discharge effluent to the Animas River is located 11.2 miles upstream from the City of Durango's raw water intake for public water supply. This intake is used only during peak summer peiods, thus at peak river flows and peak dilution of any pollutants.
4. May facilitate growth in the Hermosa area with attendant secondary impacts.	Present zoning ordinances require three acres of land per dwelling unit in order to accommodate an on-site disposal system. The availability of sewers may relax this constraint on high density development. This is especially important in view of the annual review of land use ordinances and competing interests regarding land use management practices. The probability of high density development occurring is not considered great since there presently exists a mechanism to accommodate growth (i.e. aerated lagoons) were it desired by local residents.
5. Results in the permanent conversion of approximately three acres of land.	This includes the three acres for the treatment lagoon plus areas necessary for the three lift stations and other auxillary facilities, e.g., chlorinator. This impact, when weighed against the benefits of reclaiming land currently occupied by existing package plants, is considered insignificant.
6. May degrade aesthetic quality of area immediately adjacent to proposed site, e.g., odors, insect nuisance, visual degradation.	
7. May cause construction-related impacts, e.g., noise, dust, erosion hazard, and disruption of traffic flow along pipeline alignments.	Impacts are temporary and considered minimal; disturbed areas along pipeline alignments will be restored to pre-construction conditions after project completed; most construction activities in existing right-of-ways.

TABLE 5.3 (continued)

Impacts/Issues	Comments
	Treatment facility and lift Stations: 3 acres Subalternative 1: 3.4 miles alignment 5 highway crossings -Trimble Lane (1) -U.S. Hwy 550 (2) -West Animas Road (1) -Hermosa Meadows Road (1) Subalternative 2: 4.5 miles alignment 1 stream crossing -Hermosa Creek 6 highway crossings -Trimble Lane (1) -U.S. Hwy 550 (3) -West Animas Road (1) -Hermosa Meadows Road (1) Subalternative 3: 6.0 miles alignment 1 stream crossing (as Subalt. 2) 6 highway crossings (as Subalt. 2)

Water is available from the Animas Water Company, septic tanks function adequately and roads are average for the Durango area. There is a ban on additional package plants pending resolution of a water quality problem downstream in the Animas River, but new aerated lagoon systems are permitted for developments with lots too small for septic tanks. The desired growth pattern calls for densities ranging from urban, at Hermosa center, to one unit per 40 acres.

If a central wastewater treatment plant is built at Trimble Lane to serve Subarea 1a (the southern portion of the Study Area), it would have little impact on development potential in the area because development too dense for septic systems is already permitted where aerated lagoon treatment systems are installed. Development potential could change if the presence of a treatment plant creates additional political pressures to allow greater residential density than is currently permitted by the desired growth plan.

Construction of a central treatment plant would also have little effect on the desirability of new development in the Hermosa Study Area. The area has historically been considered attractive and has no conditions that currently inhibit development. Conflicts about growth among area residents may become sharper over time, however, especially if the density limit imposed by the minimum three-acre lot for septic requirement is removed. It should be noted that the area's electorate voted in June 1980 to reject establishment of a Hermosa Sanitation District, which would have been a first step toward enabling construction of a central treatment plant.

Another important issue is the potential for water quality degradation to the Animas River resulting from effluent discharge. The proposed outfall is located 11.2 miles upstream from the City of Durango's raw water intake for public water supply. The proposed facility, while removing BOD, solids, and coliform bacteria, will not remove nutrients such as nitrogen and phosphorus which are important to algal growth. Only tertiary treatment would eliminate these nutrients. The impact of this nutrient discharge to the river is considered negligible in view of the small amount of discharge relative to the dilution volume of the river. Durango's raw water intake is used only during peak summer periods, thus at peak river flows and peak dilution of any pollutants.

Possible mitigation measures for adverse impacts are summarized in Table 5.4.

Other Alternatives

Environmental impact analyses were conducted on three other alternative wastewater management plans for the Hermosa area. These alternative include:

1. Establishment of a Maintenance District,
2. Collection and Interceptor lines to connect with Durango facility, and
3. No Action.

Impacts associated with these alternatives are presented in Table 5.5. An additional alternative addressed in the Facilities Plan (i.e., extension of sewer lines into Baker's Bridge area) was eliminated from consideration early in the facilities planning study as not cost-effective and, thus, is not analyzed in the impact assessment.

JUNCTION CREEK

Recommended Alternative

The recommended alternative for the Junction Creek area involves installing an inceptor to connect with the City of Durango System. Issues, potential beneficial impacts and adverse impacts associated with the recommended alternative are presented in Tables 5.6 and 5.7.

The effect of the recommended alternative on growth is considered an important issue. There are currently about 78 living units in the Junction Creek Study Area. There are two approved subdivisions which together would contain 587 units at ultimate development. One of these

TABLE 5.4

POSSIBLE MITIGATION MEASURES FOR POTENTIAL ADVERSE IMPACTS ASSOCIATED WITH RECOMMENDED ALTERNATIVE FOR HERMOSA AREA

Impact	Mitigation
1. Flood hazard.	The potential hazard from flooding was considered in the site selection process and design of the facility. Flood level studies have been conducted and protection against a 100-year flood will be provided. Adherence to Federal guidelines, including a grant condition prohibiting taps from new development in the flood plain and adequate flood proofing of the treatment plant will reduce the flood hazard.
2. Water quality degradation.	The proposed treatment facility will be designed to provide effluent of sufficient quality to meet state and Federal criteria for protection of water quality.
3. Growth facilitation.	Strict adherence to land use plans and zoning ordinances designed to provide orderly, well-managed growth will prevent uncontrolled development facilitated by the proposed alternative. Adherence to land use plans and ordinances is a local matter, however, and EPA has limited authority over decisions made at the discretion of local authorities.
4. Aesthetics degradation at new treatment facility.	The treatment facility plant will be designed and operated in a manner to prevent odor and insect nuisance from becoming a problem. Landscaping the proposed facility to blend in with the surrounding environment will mitigate against visual degradation. The lagoon system may enhance local aesthetics if landscaped and managed for desired goals such as waterfowl use, etc.
5. Construction-related impacts.	Standard engineering practice will keep construction related impacts to a mininum. Excavated areas will be kept to the minimum required for safe, efficient operation of equipment. Existing rights-of-way will be used where possible. Disturbed areas along alignments will be restored.

TABLE 5.5

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO THE RECOMMENDED PLAN FOR THE HERMOSA AREA

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plants. Improved operation of package plants by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Monthly user costs to support District administration, equipment, and staff are more than double the costs of the recommended plan. Preliminary estimate is $19.94/month assuming 480 users.
	3. Continued septage handling requirement.

COLLECTION AND INTERCEPTOR LINES TO CONNECT WITH DURANGO FACILITY

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary estimate is $18.99/month assuming 480 users.
2. Releases present package plant property to alternative land uses, thereby improving local aesthetic quality in areas near these facilities.	2. May facilitate growth and strip development in Animas Valley with attendent secondary impacts.

TABLE 5.5 (continued)

Beneficial Impacts	Adverse Impacts
3. Results in net reduction in energy usage.	3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow among pipeline alignment.

NO ACTION

Beneficial Impacts	Adverse Impacts
1. No additional economic burden to residents except those associated with upgrading or replacing failing systems.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Continued septage handling requirements.

has a commitment from the City of Durango for wastewater treatment, but that commitment would use up all remaining capacity in the sewer line serving the area. Other development constraints in the area include a limited amount of water, few paved roads, steep slopes on the northern and western edges of the area and the presence of Chapman Lake, seasonally replenished by snowmelt, in the center. The Federal Bureau of Land Management owns a sizable amount of land in the eastern portion of the area, on Animas City Mountain. Area residents are opposed to significant additional development.

The extension of a sewer line to Junction Creek Mobile Home Park would marginally increase development potential in the area it serves, because there is only a relatively small amount of land available for development in that portion of the Study Area. The scarcity of water in Junction Creek will remain as a constraint on development potential, as will the slope hazards in the north and west. The project would, however, remove an existing moratorium on development that would hook into the city sewer system.

The installation of a sewer line up to the mobile home park is also unlikely to increase the Study Area's relative attractiveness for future development. More important factors, which will remain to inhibit future growth, are the area's relative seclusion, high altitude (which brings with it more severe winters than in the valley below) and lack of paved roads. The one subdivision in the area with central sewer (Jacob's Cliffs) has not experienced a significant amount of development.

Possible mitigation measures for adverse impacts are summarized in Table 5.8.

Other Alternatives

Environmental impact analyses were conducted on five other alternative wastewater management plans for the Junction Creek area. These alternatives include:

1. Collection and interceptor lines for all of Junction Creek drainage to connect with Durango system,
2. Collection and interceptor lines to West Animas Sanitation District via Spring Creek,

TABLE 5.6

POTENTIAL BENEFICIAL IMPACTS AND ISSUES ASSOCIATED WITH THE RECOMMENDED ALTERNATIVE FOR JUNCTION CREEK AREA

Impacts/Issues	Comments
1. Enhances safeguards to public health and to water quality.	Eliminates continued reliance on the one package plant in the area that has a history of maintenance problems. Discharge of this plant is to Junction Creek and has resulted in water quality and aesthetic degradation seasonally, especially during periods of low flow. Eliminates reliance on on-site disposal systems. Of the 25 observed in assessment, four are probably inadequate because of high percolation rate, high ground water, and malfunctioning equipment. Three rely on evapotransportation.
2. Results in a net reduction in energy usage.	The package plant currently requires 24-hour blower operation at a substantial electric cost because of over capacity/maintenance problems. The plant currently uses 26,280 kwhr of electrical energy annually. The increased energy costs to the Durango facility for treatment of wastewater from Junction Creek are considered negligible. Therefore, the net annual energy savings is approximately 26,280 kwhr.

TABLE 5.7

POTENTIAL ADVERSE IMPACTS AND ISSUES ASSOCIATED WITH RECOMMENDED ALTERNATIVE FOR JUNCTION CREEK AREA

Impacts/Issues	Comments
1. Impose economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to sewer line and capacity rights in Durango plant.	The issue of who benefits versus who pays is considered significant. The recommended alternative is designed to correct wastewater management problems caused primarily by the one package plant in the study area which serves 38 mobile homes. Residents in five private homes would be required to connect to and to contribute financially to the project. Estimated costs are as follows: User charge: $6.81/month Tap fee: 0-$100 Service hookup: 0-$400 An additional cost which may affect residents of the proposed service area would be in the form of higher taxes resulting from becoming annexed to the City of Durango. The recommended alternative would most likely fall under the implied consent rules of the City of Durango. Implementation of this alternative may, in effect, represent an agreement by the residents to be annexed to the City at some future date by accepting City services.
2. May facilitate growth in Junction Creek area.	Current zoning is one dwelling unit per three acres. This density is due, in large part, to restrictions imposed by on-site disposal systems. The availability of sewers may relax this constraint on high density development. This is especially important in view of the fact that land use plans are reviewed annually by the County and could be modified to accommodate more growth. The likelihood of rapid growth occurring given the present conditions and attitudes in the Study Area is considered minimal.

TABLE 5.7 (continued)

Impacts/Issues	Comments
3. The facility would provide service to mobile homes located within the 100-year flood plain.	Mobile homes are especially vulnerable to flood damage and pose a hazard to others if they are carried away by flood waters.
4. Construction-related impacts, e.g. noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.	Includes 2,500 lineal feet of pipeline, part of which is replacement of existing sewer line within Durango City limits.

3. Formation of a Maintenance District,
4. Central Wastewater Treatment Facility, and
5. No Action.

Impacts associated with these alternatives are presented in Table 5.9.

LIGHTNER CREEK

Recommended Alternative

The recommended alternative for the Lightner Creek area involves installing an interceptor to connect with the existing Lightner Creek Sanitation District interceptor and to secure treatment capacity at the Durango treatment facility. Four different interceptor systems were considered, each serving a different portion of the Study Area. Option "a" in the Facilities Plan was selected. It consists of installing an interceptor from the Lightner Creek Sanitation District line along U.S. Highway 160 to Wildcat Canyon Road. Issues, potential beneficial impacts, adverse impacts, and mitigation measures associated with the recommended alternative are presented in Table 5.10.

The recommended alternative may influence growth but the degree of growth is not expected to be significant. The Lightner Creek area is divided into two distinct subareas: Lightner Creek, which is extensively developed into a variety of residential and tourist-oriented uses, and Durango West, which is a newly-developing, primarily residential subdivision. Durango West is expected to be a major growth area because it has central water and sewer and paved roads, and is only a short driving distance from the city along a major highway. Future development in Lightner Creek will be limited by the lack of available large parcels of undeveloped land and by steep slopes on both sides of U. S. Highway 160 and County Road 207.

Extension of the LCSD sewer westward along U. S. Highway 160 to the Wildcat Canyon cutoff would both accommodate existing development and create potential for additional development. This potential for additional development would be small, however, because the steep slopes on both sides of the highway severely limit the amount of available land. Further, new development is likely to be commercial (including tourist-oriented) in nature rather than residential because of the

TABLE 5.8

POSSIBLE MITIGATION MEASURES FOR POTENTIAL ADVERSE IMPACTS ASSOCIATED WITH RECOMMENDED ALTERNATIVE FOR JUNCTION CREEK AREA

Impact	Mitigation
1. Growth facilitation	Strict adherence of local officials to land use plans and zoning ordinances designed to provide orderly well-managed growth would prevent uncontrolled development facilitated by the proposed alternative. Adherence to land use plans and options is a local matter, however, and EPA has little authority over decisions made at the descretion of local authorities.
2. Flood hazard	Mobile homes, by virtue of their mobility, are well-suited to relocation to less hazardous areas. EPA recommends that mobile home park owners and local officials formulate a plan to relocate any mobile homes that may exist in the flood hazard area as defined by the Federal Emergency Management Agency, and provide flood protection for those that lie within that portion of the 100-year flood plain that lies outside the flood hazard area.
3. Construction related impacts	Standard engineering practice will keep construction related impacts to a minimum. Excavated areas will be kept to the minimum required for safe, efficient operation of equipment. Existing rights-of-way will be used where possible to minimize disturbance to undeveloped areas. Disturbed areas along the alignment will be restored to preconstruction conditions.

TABLE 5.9

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO THE RECOMMENDED PLAN FOR THE JUNCTION CREEK AREA

SEWERS TO DURANGO WEST AND ALONG JUNCTION CREEK

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plant and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to sewer line and capacity rights in Durango plant. Preliminary estimates for monthly user fees range from $8.20 to $24.30 depending on the number of users. These costs are higher than those associated with the recommended alternative because more sewer lines are required.
2. Results in a net reduction in energy usage.	2. May facilitate more extensive growth in Junction Creek area than the recommended or no action plans. Given the existing physical constraints and the prevailing attitudes of people in the Study Area, major increases in growth are not anticipated.
	3. Flood hazard same as described in Table 5.8.
	4. Construction-related impacts, e.g. noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

COLLECTION AND INTERCEPTOR LINES TO WEST ANIMAS SANITATION DISTRICT VIA SPRING CREEK

Beneficial Impacts	Adverse Impacts
1. Affords some benefit to public	1. Does not include existing package

TABLE 5.9 (continued)

Beneficial Impacts	Adverse Impacts
health and water quality by eliminating individual on-site disposal systems in service area. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density would render existing systems unsuitable.	plant, and thus, does not correct existing wastewater handling problem in Study Area.
	2. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system to the West Animas Sanitation District and capacity in the Durango treatment plant. Preliminary monthly user fee estimates range from $11.60 to $38.00 depending on number of users.
	3. May facilitate growth in Junction Creek and Chapman Lake areas.
	4. Results in major construction activities in undisturbed, steep slope areas north of Animas City Mountain. This area is considered critical winter range for mule deer and winter range, concentration area, and calving area for elk.
	5. Construction-related impacts, e.g. noise, dust, erosion hazard, disruption of traffic flow.

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plant. Improved operation of package plant by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used; however, it is less than that with the No Action alternative. In most

TABLE 5.9 (continued)

Beneficial Impacts	Adverse Impacts
	cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. High monthly user costs to support upgrading existing plants, District administration, equipment, and staff. Preliminary estimate is $11.32/month.
	3. Continued septage handling requirement.

CENTRAL TREATMENT PLANT AT CHAPMAN LAKE

Beneficial Impacts	Adverse Impacts
1. Affords some benefit to public health and water quality by eliminating individual on-site disposal systems in service area. In most cases, these systems appear adequate at present; however, increases in ground water levels and/or population density would render existing systems unsuitable.	1. Does not include existing package plant and, thus, does not correct existing wastewater handling problem in Study Area.
	2. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and treatment plant; preliminary cost estimate ranges from $3.85/month (350 users) to $13.48/month (100 users).
	3. Depending on size of the plant, it may facilitate growth in Junction Creek and Chapman Lake areas with attendant secondary impacts.
	4. Results in major construction activities and development in generally undisturbed area near Chapman Lake. This area is considered critical winter range for mule deer and winter range, concentration area, and calving area for elk.

TABLE 5.9 (continued)

Beneficial Impacts	Adverse Impacts
	5. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow.

NO ACTION

Beneficial Impacts	Adverse Impacts
1. No additional economic burden to residents except those associated with upgrading or replacing failing systems.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Continued septage handling requirement.

TABLE 5.10

POTENTIAL BENEFICIAL IMPACTS, ADVERSE IMPACTS, ISSUES, AND POSSIBLE MITIGATION MEASURES ASSOCIATED WITH RECOMMENDED ALTERNATIVES FOR LIGHTNER CREEK AREA

BENEFICIAL IMPACTS/ISSUES

Impacts	Comments
1. Enhances safeguards to public health and to water quality.	Eliminates one package plant (Swiss Chalet Motel) and several on-site disposal systems. The package plant appeared to be operating adequately when inspected but has a high potential of inadequate operation during its peak loading during the tourist season. Colorado Health Department recommends connecting this package plant to the Lightner Creek Sanitation District System.

ADVERSE IMPACTS/ISSUES

Impacts	Comments
1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to sewer line construction and capacity rights in the Lightner Creek Sanitation District System.	The issue of who benefits versus who pays is considered important. All residents would benefit from the reduced threat to water quality and public health. However, the recommended alternative is designed to correct anticipated wastewater management problems from one package plant. Instead of having the owners of this facility pay for repairs and/or upgrade,the recommended alternative requires all residents in the proposed service area, many of which have adequate systems, to support a plan to correct problems associated with the one package plant. Estimated costs for users: Monthly user fee: $17.50-$25.50 Tap fee: $405-$1,229 An additional cost which may affect proposed service area residents would be in the form of higher taxes resulting from becoming annexed to the City of Durango. The recommended alternative would most likely fall under

TABLE 5.10 (continued)

	the implied Consent rules of the City of Durango. Implementation of this alternative may, in effect, represent an agreement by the residents to be annexed to the City at some future date by accepting City services.
2. Could facilitate high density residential development in service area with attendant secondary impacts.	Present zoning ordinances require three acres of land per dwelling unit in order to accommodate an on-site disposal system. Developable land is generally confined to a narrow strip traversing the valley because of flood hazard potential and steep slopes. The availability of sewers may relax constraints on high density development. This is especially important in view of the annual review of land use ordinances and competing interests regarding land use management practices.
3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along alignment.	Involves 1,700 linear feet of right-of-way along US 160 and one street crossing.

MITIGATION MEASURES

Impacts	
1. Growth facilitation	Strict adherence of local officials to land use plans and zoning ordinances designed to provide orderly, well-managed growth may prevent uncontrolled high density development facilitated by the proposed alternative. Adherence to land use plans and options is a local matter, however, and EPA has little authority over decisions made at the descretion of local authorities.
2. Construction-related impacts	Standard engineering practice will keep construction-related impacts to a minimum. Excavated areas will be kept to the minimum required for safe, efficient operation of equipment. Existing rights-of-way will be used. Disturbed areas along alignments will be restored after construction.

character of existing uses and the fact that the highway is a major thoroughfare.

Improved safeguards to water quality in Lightner Creek resulting from the project are considered important because domestic wells are located in the floodplain and in some cases, within 100 feet of the creek (e.g. at Lightner Creek Mobile Home Park and Safari Lodge). Also, the E. B. Howard Condominiums obtain domestic water directly from the creek.

Other Alternatives

Environmental impact analyses were conducted on three other alternative wastewater management plans for the Lightner Creek area. These alternatives include:

1. Formation of a Maintenance District,
2. Central Wastewater treatment facility, and
3. No Action.

Impacts associated with these alternatives are presented in Table 5.11.

GRANDVIEW/LOMA LINDA

Recommended Alternative

The results of the engineering analysis presented in the Facilities Plan concluded that the most desirable, cost effective method of providing wastewater management to this Study Area would be to divide the area into two subareas and provide separate collection, conveyance, and treatment systems for each.

For the Grandview and Pinon Acres areas, the recommended alternative involves the construction of a central aerated lagoon with associated interceptors and collectors. A separate but similar system would be built in the Loma Linda and Falfa areas. In both cases, local sanitation districts would be formed to administer wastewater management activities within their respective service areas. Issues, potential beneficial impacts and adverse impacts resulting from implementation of these alternatives are presented in Tables 5.12 and 5.13.

The Grandview/Loma Linda area is probably the most vulnerable to growth and development pressures of the six Study Areas. It has the greatest amount of level, physically unconstrained land of the six Study Areas. Water is available from wells but local roads are not paved and soils are poorly suited to septic tanks. It is farther from Durango than most of the other Study Areas.

TABLE 5.11

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO RECOMMENDED PLAN FOR THE LIGHTNER CREEK AREA

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plants. Improved operation of package plants by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. High monthly user costs to support District administration, equipment, upgrading existing package plants, and staff. Preliminary cost estimates to upgrade and operate the five existing package plants range between $112 to $1,350/month per facility.
	3. Continued septage handling requirement.

CENTRAL TREATMENT FACILITY

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and treatment plant; preliminary estimate is $12.52/month user costs.

TABLE 5.11 (continued)

Beneficial Impacts	Adverse Impacts
	2. May facilitate growth and strip development in Lightner Creek area with attendant secondary impacts.
	3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment

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NO ACTION

Beneficial Impacts	Adverse Impacts
1. No additional economic burden to residents except those associated with upgrading or replacing failing systems.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Continued septage handling requirement.

TABLE 5.12

POTENTIAL BENEFICIAL IMPACTS AND ISSUES ASSOCIATED WITH RECOMMENDED ALTERNATIVES FOR GRANDVIEW/LOMA LINDA AREA

Impact/Issues	Comments
1. Enhances safeguards to public health and to ground water	Eliminates continued reliance on small package plants, many of which have a history of maintenance problems. Almost all plants were operating adequately when inspected; however, at peak loading during tourist season, many plants experience problems. Increases in loading resulting from greater influx of users, either seasonal use from tourists or increased population growth could render existing systems unsuitable. Many do not have sufficient land area available for expansion. Most package plants are non-discharging thereby imposing minimal threat to surface water quality. Soils in the area do not allow appreciable percolation; however, they are subject to high shrink/swell potential. There is concern that during dry weather, extensive cracks which develop in the soils could provide an avenue by which inadequately treated wastewater could enter the ground water system. Due to the reliance on shallow wells for drinking water in the Study Area, this is considered a serious threat to public health.
2. Improves aesthetics.	The existing package plants and 32 of the 37 individual on-site disposal systems surveyed rely on surface lagoons or evapotranspiration systems for wastewater disposal. Such systems, if not diligently maintained, are subject to odor and visual degradation problems. Many of the existing systems have a history of such problems. Elimination of these systems will improve local aesthetic characteristics in these areas.

TABLE 5.12 (continued)

Impact/Issues	Comments
3. Results in net reduction in energy usage.	Discontinued operation of existing package plants will conserve approximately 59,100 kwhr of power annually. The projected annual power consumption estimates for the Grandview and Loma Linda treatment facilities are 17,520 kwhr and 13,580 kwhr, respectively, or 31,100 kwhr, collectively. Implementation of the recommended alternatives results in a net decrease in electrical energy usage of 28,000 kwhr each year.
4. Result in greater reliability of wastewater treatment capability in Grandview/Loma Linda area for improved water quality control.	Regional facilities will have (1) better equipment, (2) better and more uniform operator capabilities, and (3) back-up power supplies, i.e., generators, to assure continued operation in the event of a power outage.
5. Releases present package plant and on-site disposal facilities properties to alternative land uses.	Land currently used to house wastewater disposal facilities is, collectively, approximately 1.5 acres located at 18 separate sites. Implementation of the recommended alternatives will release about 1.4 acres to other land uses. Approximately four acres of land will be required for the two aerated lagoons.

TABLE 5.13

POTENTIAL ADVERSE IMPACTS AND ISSUES ASSOCIATED WITH RECOMMENDED ALTERNATIVES FOR GRANDVIEW/LOMA LINDA AREA

<table>
<tr><th></th><th>Impacts/Issues</th><th>Comments</th></tr>
<tr><td>1.</td><td>Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to the regional collection system and treatment facility.</td><td>The issue of who benefits versus who pays is considered significant. The recommended alternatives are designed to correct wastewater management problems caused by improperly operated systems many of which require repairs. Most of the 18 multiple input treatment facilities appeared to be operating adequately at the time of the survey but 11 either were experiencing problems, have a history of problems, or are expected to have operation difficulties in the future. Several of the individual on-site facilities examined in the survey are in need of repair. The recommended plans would require all residents in the proposed service areas instead of just the individual owner to pay for repairs to faulty or inadequate systems. Many of the faulty systems require upgrading and expansion. In some cases, no land is available to expand existing systems. Estimated costs for the recommended alternatives are:
<table>
<tr><th>Grandview</th><th>User Charge</th><th>Tap Fee</th><th>Service Hook-up</th></tr>
<tr><td>Subalt.1</td><td>$11.49/mo</td><td>$700</td><td>$500-$1500</td></tr>
<tr><td>Subalt.2</td><td>$11.90/mo</td><td>$700</td><td>$500-$1500</td></tr>
<tr><td>Subalt.3</td><td>$10.68/mo</td><td>$700</td><td>$500-$1500</td></tr>
<tr><td>Loma Linda</td><td>$11.21/mo</td><td>$700</td><td>$500-$1500</td></tr>
</table></td></tr>
<tr><td>2.</td><td>May facilitate growth in the Grandview/Loma Linda area with attendant secondary impacts.</td><td>Land use plan for Grandview and Pinon Acres is designated at one dwelling unit per five acres. In the Loma Linda and Falfa areas a designation has been made of irrigated land which is a semi-dormant designation indicating low priority for division of lands. Suggested densities vary between one dwelling unit per five acres and one per ten acres. Although it is currently designated as an area of low density development, the Grandview/Loma Linda area has been identified by local planners as a possible future growth center.</td></tr>
</table>

TABLE 5.13 (continued)

Impacts/Issues	Comments
	The availability of sewers may relax constraints on high density development. This is especially important in view of the annual review of land use ordinances and competing interests regarding land use management practices.
3. Results in permanent conversion of approximately four acres of land for local lagoon systems.	This includes the two acres each for the two treatment lagoons plus land necessary for auxillary facilities, e.g., chlorinator and lift stations.
4. May degrade aesthetic quality of area immediately adjacent to proposed lagoon site, e.g., odors, insect nuisance, visual degradation.	This impact is considered minimal when compared to eliminating 18 package plant sites and approximately 35 individual systems, many of which currently create odor and visual degradation nuisance. Also, measures are available to mitigate such occurrences.
5. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignments.	Impacts are temporary and are considered minimal. Disturbed areas along pipelines will be restored to pre-construction conditions after project completed. Most construction activities for alignments will be confined to existing rights-of-way Grandview Treatment lagoon: 2 acres Sewer lines: 3.2 miles 1 highway crossing Loma Linda Treatment lagoon: 1.5-2 acres Sewer lines: 2.0 miles

The recommended alternative could increase development potential there and would almost certainly increase the area's attractiveness to new development. An increase in development potential would depend on the effectiveness of the desired growth pattern, which limits residential densities to one living unit per six acres along U.S. Highway 160. If collective wastewater systems were installed, it is possible that the plan would be changed to allow greater density. The more important impact of wastewater projects in this area, however, is on the probability of future development. Soil conditions that are not well suited to septic systems have been a major factor in inhibiting growth. Removal of this constraint through installation of a collection system in all or part of the Study Area would greatly enhance the area's attractiveness and increase the probability that future development would locate there.

Possible mitigation measures for adverse impacts resulting from implementation of the recommended alternative are summarized in Table 5.14.

Other Alternatives

Environmental impact analyses were conducted on three other alternative wastewater management plans for the Grandview/Loma Linda area. These alternatives include:

1. Collection and interceptor lines to the City of Durango treatment facility,
2. Formation of a Maintenance District, and
3. No Action.

Impacts associated with these alternatives are presented in Table 5.15. An additional alternative addressed in the Facilities Plan (i.e. interceptor line to Animas Air Park) is actually a suboption of alternative 1 above which is to convey wastewater to the Durango facility.

FLORIDA ROAD

Recommended Alternative

The No Action alternative was recommended for the Florida Road area. The major beneficial impact is no additonal economic burden to residents except those associated with upgrading or replacing failing systems. A significant potential adverse impact is the continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable. The Sanitary Survey revealed that one package plant is experiencing operation difficulties. The individual on-site disposal systems examined all appear satisfactory. Another adverse impact associated with the no action alternative is the continued septage handling requirement. Mitigation for adverse impacts associated with the No Action alternative can be accomplished by any of the non-selected alternatives.

Other Alternatives

Environmental impact analyses were conducted on three other alternative wastewater management plans for the Florida Road area. These alternatives include:

1. Collection and interceptor lines to Durango treatment plant,
2. Central wastewater treatment facility, and
3. Formation of a Maintenance District.

Impacts associated with these alternatives are summarized in Table 5.16. An additional alternative addressed in the Facilities Plan (i.e. short interceptor from the B & C Mobile Home Park to Durango) is actually a variation of alternative 1 above which is to convey wastewater to the Durango facility.

WEST ANIMAS

Recommended Alternative

The recommended alternative for the West Animas area is No Action. The major beneficial impact is no additional economic burden to residents except that associated with upgrading or replacing failing systems. A significant potential adverse impact is the continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.

TABLE 5.14

POSSIBLE MITIGATION MEASURES FOR POTENTIAL ADVERSE IMPACTS ASSOCIATED WITH RECOMMENDED ALTERNATIVES FOR GRANDVIEW/LOMA LINDA AREA

Impact	Mitigation
1. Growth facilitation	Strict adherence by local officials to land use plans and zoning ordinances designed to provide orderly, well-managed growth will prevent uncontrolled development facilitated by the proposed alternative. Adherence to land use plans and options is a local matter, however, and EPA has little authority over decisions made at the descretion of local authorities.
2. Aesthetics degradation at new treatment facilities.	The treatment plants will be designed and operated in a manner to prevent odor and insect nuisance from becoming a problem. Landscaping the proposed facilities to blend in with the surrounding environment will mitigate against visual degradation. The lagoon systems may enhance local aesthetics if landscaped and managed for desired goals such as wetlands, waterfowl areas, etc.
3. Construction-related impacts.	Standard engineering practice will keep construction-related impacts to a mininum. Excavated areas will be kept to the minimum required for safe, efficient operation of equipment. Existing rights-of-way will be used where possible. Disturbed areas along alignments will be restored.

TABLE 5.15

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO THE RECOMMENDED PLANS FOR THE GRANDVIEW/LOMA LINDA AREA

COLLECTION AND INTERCEPTOR LINES TO THE CITY OF DURANGO TREATMENT PLANT

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary monthly estimates range between \$13.82 (300 users) to \$19.78 (179 users) for Grandview and \$11.28 (300 users) to \$17.55 (150 users) for Loma Linda.
2. Releases present package plant property to alternative land uses, thereby improving local aesthetic quality in areas near these facilities.	2. May facilitate growth and strip development with attendant secondary impacts, as described for recommended alternative.
3. Result in net reduction in energy usage.	3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plants. Improved operation of package plants by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.

TABLE 5.15 (continued)

	2. High monthly user costs to support District administration, equipment, and staff.
	3. Continued septage handling requirement.

NO ACTION

Beneficial Impacts	Adverse Impacts
1. No additional economic burden to residents except those associated with upgrading or replacing failing systems.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operations problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Continued septage handling requirements.

Existing wastewater treatment in the West Animas area is by individual treatment systems and by a non-discharging extended aeration plant followed by an oxidation ditch. The existing residential units in the West Animas area are fairly old and it is suspected that several leach fields need to be upgraded to current standards. The area is constrained for on-site systems by the Animas River flood plain and high ground water. The Lazy-U-Rancho operates on extended aeration plant followed by a non-discharging oxidation ditch. The facility is overloaded and 24-hour summer blower operation is required simply to prevent odors, with a resulting low level of treatment. An additional adverse impact associated with the No Action alternative is the continued septage handling requirement. Mitigation for adverse impacts associated with the No Action alternative can be accomplished by any of the nonselected alternatives.

Other Alternatives

Environmental impact analyses were conducted on three other alternative wastewater management plans for the West Animas area. These alternatives include:

1. Collection and interceptor lines to Durango treatment facility,
2. Central wastewater treatment facility, and
3. Formation of a Maintenance District.

Impacts associated with these alternatives are summarized in Table 5.17.

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Durango area has historically been used for residential and recreational purposes. The Study Area provides habitat for vegetation and wildlife and serves as valuable watershed. These uses will not be significantly affected by any of the wastewater management alternatives considered in the Facilities Plan.

Sewering, either with central treatment in respective Study Areas or connection to the City of Durango's facilities, would provide the best long-term protection for water quality and public health; however, it will impose a significant financial burden on residents. It would also

TABLE 5.16

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO THE RECOMMENDED PLAN FOR FLORIDA ROAD AREA

COLLECTION AND INTERCEPTOR LINES TO DURANGO

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary monthly cost estimates range from $12.66 to $26.34.
	2. May facilitate growth and strip development with attendant secondary impacts. Development would probably be limited because of limitations on water supply and undeveloped land.
	3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

CENTRAL WASTEWATER TREATMENT PLANT

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary monthly cost estimates range from $15.22 to $32.80.
2. Greater reliability of wastewater treatment capability because of better equipment, better and more uniform operator capability, and backup power supply to assure continued operation in the event of a power outage.	2. May facilitate growth and strip development with attendant secondary impacts. Development would probably be limited because of limitation on water supply and undeveloped land.
	3. Permanent conversion of land area required for lagoon system.

TABLE 5.16 (continued)

Beneficial Impacts	Adverse Impacts
	4. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plants. Improved operation of package plants by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. Monthly user costs higher than those associated with no action to support District administration, equipment, and staff. Preliminary estimate is from $3.00 to $12.00/month.
	3. Continued septage handling requirement.

TABLE 5.17

POTENTIAL IMPACTS ASSOCIATED WITH ALTERNATIVES TO THE RECOMMENDED PLAN FOR WEST ANIMAS AREA

COLLECTION AND INTERCEPTOR LINES TO DURANGO

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary monthly cost estimates range from $15.09 to $30.52.
	2. May facilitate growth and strip development in Animas Valley with attendant secondary impacts. However, most of the area is subject to physical constraints such steep slopes and flood plain. Thus, only a small amount of land is available. The likelihood of significant changes in growth patterns is considered minimal.
	3. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

CENTRAL WASTEWATER TREATMENT PLANT

Beneficial Impacts	Adverse Impacts
1. Enhances safeguards to public health and to water quality by eliminating reliance on small package plants and on-site disposal systems.	1. Imposes economic burden on residents who are presently using satisfactory on-site disposal systems but who will be required to connect and/or contribute financially to new conveyance system and capacity of Durango treatment plant; preliminary monthly cost estimates range from $10.54 to $22.51.

TABLE 5.17 (continued)

Beneficial Impacts	Adverse Impacts
2. Greater reliability of wastewater treatment capability because of better equipment, better and more uniform operator capability, and back-up power supply to assure continued operation in the event of a power outage.	2. May facilitate growth and strip development in Animas Valley with attendant secondary impacts. However, most of the area is subject to physical constraints such as steep slopes and flood plain. Thus, only a small amount of land is available. The likelihood of significant changes in growth patterns is considered minimal.
	3. Permanent conversion of land area required for lagoon system.
	4. Construction-related impacts, e.g., noise, dust, erosion hazard, disruption of traffic flow along pipeline alignment.

MAINTENANCE DISTRICT

Beneficial Impacts	Adverse Impacts
1. Lessening of threat to public health and water quality by upgrading faulty on-site disposal systems and package plants. Improved operation of package plants by providing a licensed Class C or better operator.	1. Continued threat to public health and water quality associated with on-site disposal and reliance on small package plants that are subject to maintenance/operation problems. This threat will persist as long as such systems are used. In most cases, these methods of treatment and disposal appear adequate at present; however, increases in ground water levels and/or population density could render existing systems unsuitable.
	2. High monthly user costs to support District administration, equipment, and staff. Preliminary estimate is from $4.00 to $20.00/month.
	3. Continued septage handling requirement.

relax existing constraints on growth and development in certain Study Areas such as Grandview/Loma Linda, Hermosa, and Junction Creek. A significant benefit resulting from sewering would be a decrease in current and projected energy use that would occur by retiring several of the existing package plants. Individual on-site disposal systems and package plants would impose less of a financial burden on residents (except those required to upgrade deficient systems), but the threat to water resources and public health would continue and perhaps get worse as development proceeds in the Durango Study Area.

ANY SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTIONS SHOULD THEY BE IMPLEMENTED

Materials utilized in the construction of septic tanks, leach fields, collection and conveyance systems, treatment facilities and disposal lagoons will not be available for other purposes. The energy resources (fossil fuel, human and electric power) of the area will be tapped in order to construct any of the proposed facilities. However, this may be somewhat offset by the energy savings that would be realized by replacing existing systems that on an aggregate basis consume more power than would the proposed facilities. Each of the above commitments involves resources that are limited in the broadest definition, but are not limited on a State, regional, and/or local level. The conversion of land to house any treatment and disposal facilities is considered an irreversible change.

CONSISTENCY WITH AIR QUALITY PLANS

Section 176(c) of the Clean Air Act requires a determination of the consistency between federally funded projects and the air quality plan for the area. This wastewater treatment plan must be consistent with the air quality plan prepared by the San Juan Basin (Region 9) planning agency in Durango. EPA has concluded that the project is consistent with the air quality plan and other requirements of the Clean Air Act based on the following: 1) No State or federal air quality permits are required for the project because there will be no significant emissions from the treatment system; 2) Population projections used in the facility plan are consistent with the air quality plan; and 3) The project complies with all other requirements of the air quality plan for the San Juan Basin.

CHAPTER 6

PUBLIC PARTICIPATION

CHAPTER 6

PUBLIC PARTICIPATION

During the course of the 201/EIS study, meetings were held to inform the public and to solicit public comment. These meetings involved the public at large, vested interest groups, and governmental entities at the Federal, state, regional and local level. On 19 March 1979, following notification in the local newspaper (Durango Herald, 18 March 1979), the Initial Public Meeting was held to discuss the need for and goals of the 201/EIS study, solicit membership in the Citizens Advisory Group (CAG), and to explain the roles of the various participants in the study. Membership in the Citizens Advisory Group was finalized in July 1979. Mr. Joe Bowden was appointed Public Participation Coordinator to serve as liaison between the general public, the CAG, and the contractors performing work on the EIS and Facilities Plan. The CAG met regularly throughout the duration of the project (generally once each month). During the project, a decision was made to replace the facilities planning engineer and the CAG was asked by the La Plata County Commission to review the qualifications of several engineering firms and recommend the firm best suited to complete the 201 Facilities Plan. This was accomplished and the firm recommended by the CAG was authorized by the Commission to complete the 201 study.

ES staff attended three CAG meetings (19 July, 12 and 19 September 1979) to present information on the progress of the EIS and to answer questions raised by the CAG. A series of public meetings was held in May 1980 for each of the communities within the Study Area to discuss the alternatives being considered for the respective subareas and to solicit public comment. Information obtained from the area residents was incorporated into the decision-making process for selection of the apparent best alternative for each area.

CHAPTER 7

LIST OF PREPARERS

CHAPTER 7

LIST OF PREPARERS

Environmental Protection Agency

John Brink - Ecologist

B.A. in Biology from Washington University, St. Louis. Master of Forest Science from Yale University. Ten years experience in environmental management, impact assessment, and ecological studies.

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Gary L. Potter - Project Manager

B.A. in Zoology from University of California at Santa Barbara, Ph.D. in Biological Sciences from Dartmouth College. Fifteen years experience in the field of environmental studies. Projects managed have included wastewater studies in Arkansas, California, Colorado, Louisiana, and Texas.

Glynnis Fowler - Environmental Scientist

B.S. in Biology from the College of William and Mary. Four years experience in air pollution and air quality control, expecially PSD permitting.

Paul N. Seeley - Environmental Scientist

B.A. in Environmental Biology from the University of Colorado. Seven years experience in water quality monitoring, water resource planning, and a variety of wastewater treatment and disposal projects.

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B.S. in Biology from the University of South Carolina, M.S. in Wildlife Biology, Clemson University. Eleven years experience in environmental management, impact assessment, and resource planning.

Janet L. Snyder - Environmental Scientist

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B.S. in Civil Engineering from the University of Texas. Three years experience in industrial solid waste and wastewater disposal projects.

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The following persons were contacted during preparation of this document. Although most were not cited as references they provided useful information utilized in this study.

Federal

Fischer, Marshall P. - Compliance Assurance Section, U.S. Environmental Protection Agency, Denver.

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State

Balliger, Robert - Colorado Department of Health, Durango.

Bell, Orlyn - Colorado Division of Water Resources.

Gresh, Art - Colorado Division of Wildlife, Durango.

Haig, Bill - Air Pollution Division, Colorado Department of Health, Denver.

Hess, Lloyd - Director, Colorado Division of Planning, Region 9.

Lile, Daries C. - District Engineer, Colorado Division of Water Resources.

Moore, Ray - Air Pollution Division, Colorado Department of Health, Denver.

Olterman, Jim - Colorado Division of Wildlife, Montrose.

Schrupp, Donald - Colorado Division of Wildlife, Denver.

Weber, Dave - Colorado Division of Wildlife, Denver.

Durango City/LaPlata County

Ebel, Clayton - La Plata County Assessor.

Green, Herbie - Durango Public Works Department.

Jack, Ron - City Manager

Rank, Robert W. - City Manager.

Thompson, Sandy - Councilmember, Durango City Council.

Other Sources

Allen, Cap - Facility Plan engineer.

Bowden, Joe - Chairman, 201 Study Citizens' Advisory Group.

Francis, Ken - Field Representative, Colorado Department of Local Affairs; Member, 201 Study Citizens' Advisory Group.

Haver, Earl - Basin Reproduction.

Heggen, Mary - Phillips Brandt Reddick Regional Planning

Kirkpatrick, Bruce - Attorney

McCormick, Robert - Member, 201 Study Citizens' Advisory Group.

McDaniels, Lawrence - Attorney, McDaniels and McDaniels.

Murphy, John - LaPlata Electric Association, Durango.

Neal, Nancy - Red Mountain Realty.

Reynold, Dallas - Phillips Brandt Reddick Regional Planning.

Saunders, Jackie - Member, 201 Study Citizens' Advisory Group.

Short, Bud - Member, 201 Study Citizens' Advisory Group.

Vandegrift, Lynn - Vandegrift & Associates

Voelker, John - Member, 201 Study Citizens' Advisory Group.

Welch, Jasper - Durango Chamber of Commerce.

Wheat, Don - Colorado West.

White, Lillian - Member, 201 Study Citizens' Advisory Group.

Wolf, Tim - Phillips Brandt Reddick Regional Planning.

Yates, Russell - Attorney.

REFERENCES

1. Allen, C. 1980. Durango/La Plata County, Colorado 201 Sewer Facilities Plan.

2. Brogden, R.F., and T.F. Giles. 1976. Availability and Chemical Characteristics of Ground Water in Central La Plata County, Colorado. U.S. Department of the Interior, Geological Survey. Water-Resources Investigations 76-69, Open File Report.

3. Colorado, State of, Department of Local Affairs (in cooperation with San Juan Regional Commission). 1978. Water Quality Management Plan for the San Juan Region.

4. Gruen Gruen + Associates. 1980. Socioeconomic Conditions and Wastewater Facilities Projects.

5. Haig, William. 1980. Colorado Department of Health, Denver, Colorado. Personal Communication.

6. Henningson, Durham, and Richardson, Inc. 1977. City of Durango, Colorado, 201 Facility Plan.

7. Murphy, J. 1980. La Plata Electric Association, Durango, Colorado. Personal Communication.

8. Neal, N. 1980. Red Mountain Realty, Durango, Colorado. Personal Communication.

9. Wuerthele, M. 1974. Water Quality Survey of the San Juan Basin, Summer, 1974. Colorado Department of Health, Water Quality Control Division.

10. Yates, R. 1980. Attorney, Durango, Colorado. Personal Communication.

DISTRIBUTION LIST

The agencies and interested groups that have been requested to comment on the draft EIS are listed below.

Federal Agencies

U.S. Forest Service
Denver, Colorado

U.S. Forest Service
Durango District
Durango, Colorado

Federal Highway Administration
Denver, Colorado

Regional Director
Water and Power Resources Service
Denver, Colorado

Director
Durango Projects Office
Water and Power Resources Service
Durango, Colorado

Regional Director
Heritage Conservation and
Recreation Service
Denver, Colorado

Regional Director
U.S. Fish and Wildlife Service
Denver, Colorado

District Engineer
U.S. Army Corps of Engineers
Sacramento District
Sacramento, California

State Conservationist
U.S. Soil Conservation Service
Denver, Colorado

Regional Director
U.S. Department of Education
Denver, Colorado

Regional Director
U.S. Department of Health
and Human Services
Denver, Colorado

Regional Administrator
U.S. Department of Housing
and Urban Development
Denver, Colorado

State Director
Farmers Home Administration
U.S. Department of Agriculture
Denver, Colorado

District Chief
U.S. Geological Survey
Denver, Colorado

Regional Director
National Park Service
Denver, Colorado

Director
Environmental Project Review
U.S. Dept. of the Interior
Office of the Secretary
Washington, D.C.

Mr. James Biddle
President, National Trust for
Historic Preservation
Washington, D.C.

State Director
Bureau of Land Management
Denver, Colorado

Director
Bureau of Land Management
San Juan Resource Area Office
Durango, Colorado

Federal Agencies (continued)

Ray Kogovsek
U.S. House of Representatives
Washington, D.C.

William Armstrong
U.S. Senate
Washington, D.C.

Field Representative
Office of the Secretary of the Interior
Denver, Colorado

Gary Hart
U.S. Senate
Washington, D.C.

Regional Health Administrator
U.S. Public Health Service
Denver, Colorado

State Agencies

State Clearinghouse
Division of Planning
Denver, Colorado

Director, Colorado Water Quality Control Division
State Department of Health
Denver, Colorado

Colorado Air Pollution Control Division
State Department of Health
Denver, Colorado

Colorado State Board of Land Commissioners
Denver, Colorado

Colorado State Land Use Commission
Denver, Colorado

Environmental Division
Colorado Division of Highways
Denver, Colorado

208 Coordinator
Denver, Colorado

Colorado Department of Natural Resources
Denver, Colorado

Wildlife Conservation Officer
Durango, Colorado

Colorado Division of Wildlife
Denver, Colorado

Colorado Division of Highways
Denver, Colorado

Robert Denier
Colorado House of Representatives
Denver, Colorado

Dan Noble
Colorado Senate
Denver, Colorado

Colorado State Water Conservation Board
Denver, Colorado

LaPlata County/City of Durango

LaPlata County Health Dept.
Basin Health Unit
Durango, Colorado

City of Durango
Durango, Colorado

LaPlata County Commissioners
Durango, Colorado

San Juan Regional Commission
Durango, Colorado

Other

Lightner Creek Sanitation District
Durango, Colorado

Phillips, Brandt, Reddick, Inc.
Durango, Colorado

Sierra Club
Denver, Colorado

Denver Audubon Society
Denver, Colorado

Rocky Mountain Center on
Environment
Denver, Colorado

Thorne Ecological Institute
Boulder, Colorado

Environmental Impact Assessment
Project
Washington, D.C.

Colorado Municipal League
Wheatridge, Colorado

Colorado Wildlife Federation
Boulder, Colorado

Environmental Action of Colorado
Denver, Colorado

Environmental Defense Fund
Denver, Colorado

Durango Herald
Durango, Colorado

West Animas Sanitation District
Durango, Colorado

201 Advisory Group
Durango, Colorado

National Audubon Society
Boulder, Colorado

National Wildlife Federation
Washington, D.C.

Colorado Ski Country USA
Denver, Colorado

Today
Durango, Colorado

Trout Unlimited
Denver, Colorado

Durango Chamber of Commerce
Durango, Colorado

League of Women Voters of Colorado
Denver, Colorado

N. K. Linton, Citizens' Advisory
Group
Durango, Colorado

Joe Bowden, Citizens' Advisory Group
Durango, Colorado

Robert McCormick
Citizens' Advisory Group
Durango, Colorado

Other (continued)

Jacklyn Sanders
Citizens' Advisory Group
Durango, Colorado

Lillian White
Citizens' Advisory Group
Durango, Colorado

Lloyd Hess
Citizens' Advisory Group
Durango, Colorado

Buddy Shurac
Citizens' Advisory Group
Durango, Colorado

Del Cook
Citizens' Advisory Group
Durango, Colorado

John Voelker
Citizens' Advisory Group
Durango, Colorado

Bob Ballinger
Citizens' Advisory Group
Durango, Colorado

Ken Francis
Citizens' Advisory Group
Durango, Colorado

E. L. Hutchinson
Citizens' Advisory Group
Durango, Colorado

GLOSSARY

OF

WASTEWATER TERMS

Source:

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GLOSSARY

Technical terms not in ordinary use, and words used in the Manual in a special sense, are defined below. Definitions given in Standard D 1129[1] are not repeated here.

Absorption—Assimilation of molecules of other substances into the physical structure of a liquid or solid without chemical reaction.

Absorption, radiation—1. The process whereby the number of particles or photons emerging from a body is reduced relative to the number entering, as a result of interactions of the particles with the body.

2. The process whereby part or all of the energy of a particle or of electromagnetic radiation is lost while traversing a body of matter.

Absorption tower—A vertical structure for carrying out an absorption process.

Acid—A compound which dissociates in water solution to furnish hydrogen ions.

Acid anhydride—An oxide which will form an acid when united with water.

Acid mine drainage—Acidic drainage from bituminous coal mines, containing a high concentration of acidic sulfates, especially ferrous sulfate.

Acid radical—The anion in equilibrium with the hydrogen ion of an acid.

Acidify—To make acidic by the addition of acid or acid salt.

Acidimetry—The art of determining the acidity of aqueous solutions.

Activation—The process of inducing radioactivity in a material through nuclear bombardment, especially by neutrons.

Activation analysis—A method of chemical analysis, especially for trace quantities, based on the detection of characteristic radionuclides following nuclear bombardment.

Adsorption—Physical adhesion of molecules to the surfaces of solids without chemical reaction.

Aerobic—Living only in the presence of free oxygen.

Agglomerate—To gather together into a larger mass or cluster; to coalesce.

Albuminoid—Any of a number of substances resembling the true proteins such as collagen and keratin. A protein in its broad sense.

Algae—Simple forms of aquatic plant life which multiply only by division, but contain chlorophyll and use sunlight for photosynthesis.

Aliquot—A measured fraction of the known total volume of a solution.

Amorphous—Structure without crystalline components; having no determinate shape.

Amperometrically—Determined by measurement of electric current flowing or generated, rather than by voltage measurement.

Anaerobic—Living in the absence of free oxygen.

Analysis, chemical—Determination of the chemical elements or constituents of a compound or mixture. Also a statement of the results of such a determination.

Angstrom unit—A measurement of length usually applied to light or other radiation wavelengths—0.0001 μ, cm/10^8.

Anion—A negatively charged ion resulting from dissociation of molecules in aqueous solution.

Anode—The positive pole in an electrolytic cell which attracts negatively charged particles or ions (anions).

Anthrax—A malignant infectious disease of cattle, sheep, and other animals, and of man, caused by *Bacillus anthracis*.

Arc, visible—An electrical discharge in which radiation of wavelengths discernible by the normal human eye is produced.

Arthropods—Animals with articulate body and limbs.

Ascarite—A proprietary absorbent for carbon dioxide consisting of asbestos fibers impregnated with dehydrated sodium hydroxide.

Aspirator—A type of suction pump operated from a laboratory water tap.

Autotrophs—Microorganisms which utilize inorganic materials for energy and obtain carbon from the carbon dioxide of the atmosphere.

Background, instrument—Undesired counts or responses due to cosmic rays, local contaminating radioactivity, electronic noise, and the like. Background is sometimes used to refer to the radiation causing the undesired response.

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[1] *1968 Book of ASTM Standards*, Part 23.

Backwash—Reversed flow of liquid for cleaning or the discharge from such an operation.

Bacteria—One-celled microscopic organisms.

Bacteria, iron—Bacteria which assimilate iron and excrete its compounds in their life processes, thereby contributing to corrosion.

Bacteria, non-pathogenic—Bacteria which do not induce disease in man or the higher animals.

Bacteria, pathogenic—Microorganisms that produce disease.

Bacteria, sulfate-reducing—Bacteria which assimilate oxygen from sulfate compounds, thereby reducing them to sulfides.

Bacteriophage—A viral agent that dissolves specific bacterial cells.

Balance, water—A material account of the weight of water entering and leaving an industrial installation or process.

Basic—Alkaline.

Beam trap—A device on an X-ray-diffraction camera for absorbing the undiffracted primary X-ray beam after it has passed through the sample.

Biota, stream—The collective animal and plant life of a stream.

Birefringence—The difference between the maximum and minimum index of refraction of a crystal.

Blanket—A layer of material outside the core of a reactor in which fissionable materials are produced through neutron activation.

Blowdown—Draining off a portion of the liquid in a vessel, usually to reduce the concentration of the remaining liquid.

BOD—Biochemical oxygen demand of a water—the oxygen required for oxidation of the soluble organic matter by bacterial action in the presence of oxygen.

Bovine tuberculosis—An infectious disease affecting any of various tissues of the body due to the tubercle bacillus and characterized by the production of tubercles.

Brine—Concentrated solution, especially of chloride salts.

Bromination—Chemical treatment with bromine.

Brucellosis—Infection with bacteria of the Brucella group, frequently causing abortions in animals and undulant fever in man.

Buffer—A substance which tends to resist changes in pH of a solution.

Buffered water—Water containing dissolved or suspended material which resists changes in the pH of the water.

Calibration—The process of standardizing.

Carbonate hardness—That hardness in a water caused by bicarbonates and carbonates of calcium and magnesium.

Carryover—Entrainment of liquid or solid particles from the boiling liquid in the evolved vapor; also the particles so entrained.

Cathode—The negative pole of an electrolytic cell which attracts positively charged particles or ions (cations); the negative electrode of a vacuum tube.

Cathodic protection—Reduction or prevention of corrosion of a metal surface by making it cathodic by use of sacrificial anodes or impressed currents.

Cation—A positively charged ion resulting from dissociation of molecules in solution.

Cavitation—The formation of cavities in a liquid by rapid movement over confining or impelling surfaces and the subsequent collapse of these cavities; the destruction of metal surfaces as a result of cavitation in the liquid.

Centrifuge—A device for separating the lighter and heavier portions of a fluid by centrifugal force.

Chamber, ionization—An instrument whose response to radiation is due only to collection of the ions formed by the interaction of the radiation with the chamber materials.

Chelating agents—Chemical compounds which have the property of withdrawing ions into soluble complexes.

Chlorinator—A machine for feeding either liquid or gaseous chlorine to a stream of water.

Coagulation—The coalescence of fine particles to form larger particles.

Collimator tube—A device for defining the path of rays, such as light or X-rays.

Colloidal—Matter of very fine particle size, usually in the range of 10^{-5} to.10^{-7} cm in diameter.

Colorimeter—A device for measuring or comparing colors or colored solutions.

Colorimeter, photoelectric - cell — A colorimeter which measures the light transmitted through a solution by the response of a photoelectric cell.

Colorimetric determination—An analytical procedure based on measurement, or comparison with standards, of color naturally present in samples or developed therein by addition of reagents.

Combinations, molecular—Possible mutual arrangements of the known proportions of anions and cations present in a mixture.

Combinations, probable—The most likely manner, in the judgment of the analyst, in which the ions of a solution or the constituents of a deposit are combined into compounds in the original sample.

Combining weight—The relative or equivalent weight of an element or compound which

Fauna—Animals, or animal life.

Ferrobacillus ferrooxidans—An autotrophic bacterium which oxidizes ferrous iron under acid conditions.

Filamentous—Having the shape of a fine threadlike body or structure.

Film badge—An appropriately packaged photographic film for detecting radiation exposure of personnel.

Filter plant—The portion of a plant containing the equipment employed to strain water for the removal of suspended solids.

Filtrate—The liquid which has passed through a filter.

Filtration—The process of separating solids from a liquid by means of a porous substance through which only the liquid passes.

Fission—The splitting of a nucleus into two more or less equal fragments, usually as a result of the capture of a bombarding particle, especially a neutron. In addition to the two fragments, neutrons and gamma rays are usually emitted during fission.

Fission products—The nuclides produced by the fission of a heavy element nuclide such as uranium-233, uranium-235, or plutonium-239.

Flame photometer—Apparatus for giving a reproducible amount of emitted light for a given concentration of element in the test solution, and for determining the intensity of such emission as a function of concentration of the element without excessive interference from other emitted light.

Flashing—The conversion of a portion of a hot liquid under pressure to its vapor by release of the pressure.

Floc—A felted mass formed in a liquid medium by the aggregation of a number of fine suspended particles.

Flora—Plants, or plant life.

Flow cells—A sensing element or combination of elements, such as electrodes, immersed in a flowing liquid or gas for the purpose of measuring continuously some property of the fluid, such as electrical conductivity.

Flow diagram—The diagrammatic representation of a works process, showing the sequence and interdependence of the successive stages.

Flumed—The transportation of solids by suspension or flotation in flowing water.

Fluorescence—The absorption of radiation at one wavelength or range of wavelengths and its re-emission as radiation of longer, visible wavelengths.

Flux—The number of particles or photons passing through a surface per unit time; for electromagnetic radiation, the energy passing through a surface per unit time.

Fluxing—Addition of a low-melting compound to a substance to decrease fusion temperature of the mixture.

Geiger-Mueller tube—A gas-filled chamber with electrodes operated at a voltage such that a discharge triggered by a primary ionization event will increase until stopped by reduction of the electric field. The size of the response is independent of the unit amount of primary ionization.

Geometry—The average solid angle at the source subtended by the aperture or sensitive volume of a detector, divided by 4π. Geometry is frequently (but loosely) used to denote over-all counting efficiency.

Glass electrode—An electrode consisting of a thin glass membrane separating solutions of known and unknown pH value, the potential difference between the two sides being measured for determining the pH of the unknown.

Grain per gallon—A measure of solution concentration—17.1 ppm.

Grating—A band of equidistant, parallel, straight lines ruled on a suitable surface for systematically dispersing polychromatic light into its separate wavelength components.

Gravimetric—Measured by weight.

Ground water—Water derived from wells or springs, not surface water from lakes or streams.

Gases, half-bound—Gases, such as carbon dioxide, which are evolved by decomposition of unstable ions upon heating.

Half-life—The average time required to reduce the amount of a particular radionuclide to half its original value through radioactive disintegration.

Heat exchanger—A mechanical device by which heat is transferred from a flowing fluid within tubes to another outside the tubes.

Heat transfer—The process of removing heat from a hot body or fluid to another, usually through an intervening wall.

Heater, feedwater—A heat exchanger for raising the temperature of feedwater.

Heterotrophs—Microorganisms which must obtain carbon from organic compounds.

Homogeneous—Of uniform composition throughout.

Hot-well, condenser—Reservoir at the bottom of a condenser shell for collecting condensed water.

Humidity—The concentration of water vapor in an atmosphere.

Hydrazine—An ammonium compound, N_2H_4, which is used as an oxygen scavenger in boiler water.

Hydrometer—A buoyant instrument with graduated stem for measuring the specific gravity of liquids.

Hydroponics—Growth of plants in nutrient solution rather than in earth.

Hygroscopic—Tending to absorb moisture from the atmosphere.

Hypochlorite solution—Bleaching or sterilizing solution containing $(OCl)^-$ ion.

Incubation—Maintenance of viable organisms in nutrient solution at constant temperature for controlled growth or reproduction.

Index of refraction—Ratio of the velocity of light in the substance in question to the velocity of light in a vacuum.

Indicator—Substance which gives a visible change, usually of color, at a desired point in a chemical reaction.

Inoculate—To introduce a small amount of substance into a solution for observation of its effect such as growth or crystal formation.

Intensity, line-spectra—Intensity of the characteristic lines in the spectrum of an excited element.

Interfering substances—Materials which restrict or prevent a desired reaction, or contaminate the product.

Iodimetry—Measurement by consumption or reaction of iodine, usually in solution.

Ion—An atom or radical in solution carrying an integral electrical charge either positive (cation) or negative (anion).

Ion exchange—A process by which certain ions of given charge may be absorbed from solution and replaced in the solution by other ions of similar charge from the absorbent.

Isotropic—Having the same optical properties in all directions.

Kjeldahl determination—The chemical determination of nitrogen by which organic material is decomposed and its nitrogen converted to ammonia.

Latent energy—The energy (heat) required for a change of state at constant temperature, as the thawing of ice into water or the evaporation of water into steam.

Lattice—The uniform, three-dimensional arrangement of atoms or ion groups in a crystal.

Leach—To dissolve certain constituents from a larger mass by a slow washing operation.

Lignin—The major non-cellulose constituent of wood.

Macro—Large, as compared with micro (small).

Macro sample—One large enough to be weighed accurately on an analytical balance.

Macrochemical—On a normal scale of weights and volumes, as opposed to microchemical.

Membrane, porous—A barrier, usually thin, which permits the passage only of particles up to a certain size or of special nature.

Metabolism—The process by which food is used and wastes are formed in living matter.

Methemoglobinemia—Condition resulting from intake of excessive quantities of nitrate (blue babies).

Microbiological—Pertaining to very small living matter and its processes.

Microbiota—Microscopic plants and animals.

Microchemical—Chemical reactions on a very small scale.

Microorganism—Minute living matter.

Microscopic—Minute, very small; pertaining to a microscope.

Microscopy, chemical—Identification by microscopic observation of both chemical reactions and optical properties.

Moderator—Material used in a nuclear reactor to slow neutrons from the high energies at which they are released. Moderators are usually materials of high scattering cross-section, low atomic weight, and low absorption cross-section.

Molds—Filamentous fungi composed of many cells.

Monitoring, radioactive—Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in any area, as a safety measure for health protection.

Mother liquor—A solution substantially freed from undissolved material by filtration, decantation, or centrifuging.

MPC—Maximum permissible concentration. See Concentration, maximum permissible.

Nephelometry—Measurement of the light scattered by turbid liquids.

Nessler tubes—Matched cylinders with strain-free, clear-glass bottoms for comparing color density or opacity.

Nesslerization—A process for determining ammonia by its reaction with a mercury complex in alkaline solution.

Neutralization—Reaction of acid or alkali with the opposite reagent until the hydrogen ions are approximately equal to the hydroxyl ions in the solution.

Neutron activation analysis—Activation analysis using neutrons as the bombarding particle.

Nitrobacter—A genus of bacteria that oxidize nitrite to nitrate.

Nitrogen, organic—Nitrogen combined in organic molecules such as proteins, amines, and amino acids.

Nitrosomonas—A genus of bacteria that oxidize ammonia to nitrite.

Noncarbonate hardness—Hardness in water caused by chlorides, sulfates, and nitrates of calcium and magnesium.

Non-condensable—Gaseous matter not liquefied or dissolved under the existing conditions.

Non-referee—A method of test featuring speed and practical usefulness rather than high accuracy, which is used for process control and general information rather than in settlement of disputed test results.

Nuclide—A species of atoms with a given nuclear constitution, described by the number of protons Z, the total number of nucleons (protons plus neutrons) A, and (if necessary) the energy state. Usually only atoms capable of existing for a time of the order of 10^{-10} seconds or longer are considered to be nuclides.

Nutrient—Food.

Objective—The lens, or set of lenses, opposite the eyepiece in a microscope, which forms an image of the specimen.

Occlusion—An absorption process in which one material adheres strongly to another, usually a solid.

Opacity—The ratio of transmitted to incident light.

Orientation—The relative position of particles with respect to one another or to a reference point.

Orientation, crystal—The geometric relationship between the optical axes and an external reference.

Orifice—A restricted opening of known dimensions, usually for limitation or measurement of fluid flow.

Oxidation—Reaction of a substance with oxygen; loss of electrons by one element to another element.

Oxide—A chemical compound of a metal, or group of elements which act in common as a metal, with oxygen.

Oxide, basic—An oxide which forms hydroxide on reaction with water.

Oxygen demand—Oxygen required for oxidation of inorganic matter, or for stabilization of decomposable organic matter by aerobic bacterial action.

Pathogenic—Causing disease.

Pathogens—Pathogenic or disease-producing organisms.

Photometer—An instrument which measures the intensity of light or degree of light absorption.

Photon—The smallest unit of electromagnetic radiation. The term *photon* is most commonly used in reference to the particulate aspect of electromagnetic radiation. A photon of radiation frequency ν has an energy $h\nu$ and a momentum $h\nu/c$, where c is the velocity of light *in vacuo*.

Photosynthesis—Formation of chemical compounds in chlorophyll-containing tissues of plants exposed to light.

Physical tests—Determinations based on observation or measurement of physical properties.

Pollution—The result of discharging normally foreign material into ground or surface water.

Polyphosphate—Molecularly dehydrated orthophosphate.

Precipitate—An insoluble compound formed by chemical reaction between two or more normally soluble compounds in solution.

Priming—A carry-over of water with a sudden generation of steam, like the bumping which sometimes occurs when water is boiled in an open vessel.

Process, hot-flow—Addition of chemicals to hot water (200–212 F) passing slowly through a reaction tank.

Proliferation—The growth or production by multiplication of parts as in budding or cell division.

Protozoa—Microscopic, one-celled animals.

Purity, steam—An inverse measure of the nonwater (salts, solids, oil) constituents of steam.

Quality, steam—An inverse measure of the entrained, unevaporated moisture in steam.

Qualitative—Pertaining to the nature of component parts rather than to the amount of such components present.

Quench—To cool a material suddenly; halt abruptly a process or reaction.

Radiation—The emission and propagation of energy through space or through a material medium; also the energy so propagated.

Radioactivity—Spontaneous nuclear disintegration with emission of particulate or electromagnetic radiations.

Radionuclide—A radioactive nuclide.

Radiotracer—A tracer which is detected by means of its radioactivity.

Rainout—See Fallout.

Reactant—A substance which undergoes chemical change in contact with another substance.

Reactor—An assembly capable of sustaining a fission chain reaction.

Reconstitution—The restoration of the original characteristics of a specific water.

Recycled—Having flowed more than once through the same series of processes, pipes, or vessels.

Referee method—A method of test, usually of the highest accuracy available, which is used by mutual consent of contracting parties for establishing an acceptable value or quality in settlement of disputed test results.

Refractory—Heat-resistant; fusible with difficulty.

Regeneration—Restoration of water-treating power to an ion exchanger.

Rehydration—Recombination of water with a molecule of a chemical compound.

Reprecipitation—Dissolving a precipitate and then re-forming it by repetition of the previous procedure. (Used as a purification step in analysis.)

Residue—That which remains after a part has been separated or otherwise treated.

Resolving power—Capacity of an optical system to distinguish adjacent images.

Riparian—Of, pertaining to, or situated, or dwelling on the bank of a river or other body of water.

Rotifera—Minute, many-celled aquatic animals.

Runoff—Water flowing to a stream as a result of rainfall or melting snow.

Saprophytic organism—Any organism living on dead or decaying matter.

Scintillation—The production of light photons by the interaction of radiation with a suitable material.

Sedimentation—Gravitational settling of solid particles in a liquid system.

Self-absorption—The absorption of radiation particles or photons in the source itself.

Sequester—To form a stable, water-soluble complex.

Settling basin—Reservoir receiving water after chemical mixing to permit settling of the floc.

Shielding—Material used to prevent or reduce the passage of radiation particles or photons.

Slimes—Substances of viscous organic nature, frequently derived from microbiological growth.

Sludge blanket—A horizontal layer of solids hydrodynamically suspended within an enclosed body of water.

Softener, base-exchange—Water softener using an ion-exchange material.

Softener, lime-soda—Water softener using calcium hydrate and sodium carbonate as the reacting chemicals.

Solubility—Degree to which a substance will dissolve in a particular solvent.

Solutes—Substances which are dissolved in a liquid.

Solid solution—Mixture of two or more isomorphous substances in a single crystal form.

Species—A classification group having only minor details of difference among themselves.

Specific gravity—Ratio of the weight of any volume of a substance to the weight of an equal volume of water at 4 C.

Spectrograph—Instrument used for photographing a spectrum.

Spectrophotometry—Quantitative measurement with a photometer of the quantity of light of any particular wavelength absorbed by a colored solution, or emitted by a sample subjected to some form of excitation such as a flame, arc, or spark.

Spectroscope—Instrument used to view spectra emitted by bodies or substances.

Spectroscopy—Application of spectroscope to investigation of chemical composition.

Spore—A minute resistant body within bacteria, considered as a resting stage of bacteria.

Spray ponds—Ponds or basins in which cooling water is pumped and sprayed through nozzles, thereby reducing the water temperature by evaporation.

Stage, mechanical—The device used to manipulate a specimen under the lens of a microscope for examination.

Standardization—The manipulations necessary to bring a preparation to an established or known quality; for example, the preparation and adjustment of a standard solution in volumetric analysis.

Staphylococci—A genus of sphere-shaped, pus-forming bacteria.

Statistical uncertainty—That portion of the uncertainty of a radioactivity determination due to the random variation in the disintegration process.

Stoichiometric—The fixed weight ratios in which elements combine into chemical compounds.

Streptococci—A genus of sphere-shaped bacteria forming chains of cells; produce pus.

Strongly basic acid absorber—An ion-exchange resin in which the hydroxyl ion exhibits a very low exchange potential.

Sulfuritic material—Compounds of sulfur and iron represented by the formula FeS_2.

Superheater—A heat exchanger in which steam is heated above the equilibrium temperature corresponding to the operating pressure.

Supernatant—The liquid standing above a sediment or precipitate.

Survey meter—A portable instrument for detecting and measuring radiation under varied physical conditions.

Thermal shock—A stress-strain condition set up by a sudden change in temperature.

Titration—The determination of a constituent in a solution by the measured addition of a reactive, standard solution of known strength until the reaction is completed.

Titer—The concentration of a dissolved substance as determined by titration.

Tracer—A foreign substance mixed with or attached to a given substance to enable the distribution or location of the latter to be determined subsequently.

Tritium—A radioactive hydrogen isotope of atomic weight 3.

Tube bank—A large number of metal tubes set parallel and close together, as in a boiler.

Tube failure—Leakage or bursting of tubes resulting from corrosion, overheating, etc.

Tuberculation—A type of corrosion in which the corrosion products form blisters or nodules.

Turbidimeter—Instrument for determining the quantity of matter, in the form of fine suspended particles, in a liquid.

Turbidity—The reduction of transparency of a liquid due to the scattering of light by suspended particles.

Undulant fever—An irregular, relapsing fever, with swelling of joints, spleen, and rheumatic pains caused by Brucella organisms.

Vacuum deaeration—Equipment operating under vacuum to remove dissolved gases from water in the cold.

Vacuum-return system—A system whereby a vacuum is applied to the return pipes to facilitate the flow of condensate back to the boiler.

Viable—Living and potentially reproductive.

Virus—Submicroscopic infectious agent.

Volatile—Capable of being readily evaporated at relatively low temperature.

Volatilize—To convert into a gas or vapor.

Volumetric—Pertaining to measurement by volume, as opposed to gravimetric.

Waste—Any material which is of no further utility to the particular process involved.

Water of crystallization—Water which is an integral constituent of crystals or hydrated salts.

Water hammer—A sharp, hammer-like blow caused by the sudden stoppage of water flow in a long pressure conduit due to the rapid closing of valves. It may also be caused by the sudden collapse of steam bubbles upon entering cold water.

Weakly basic acid absorber—An ion-exchange resin in which the hydroxyl ion exhibits an exceedingly high exchange potential.

Weir boxes—Dams over which, or through a notch in which, the liquid carried by a horizontal open channel is constrained to flow for measurement.

Westphal—A type of weighing balance for determining the specific gravity of liquids and solids.

X-ray diffraction—A method of identifying crystalline substances by means of the scattering of X-rays by the constituent atoms to form characteristic patterns.

Yeasts—Broad group of fungal microorganisms causing fermentation.

Zeolite—A group of hydrated aluminum complex silicates, either natural or synthetic, with cation-exchange properties.

Zeolite, regenerating—A zeolite capable of being regenerated or converted to its original form by brine treatment.

Zeolite softeners—Equipment containing zeolite for softening water.